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HOW MOTION PICTURES ARE MADE





THE CANALS OF VENICE—JUST BACK OF LOS ANGELES

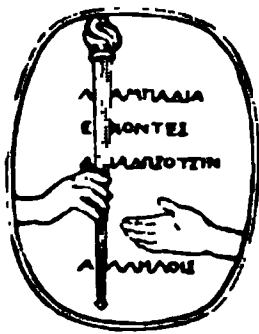
The canals and house-fronts were constructed for the use of Douglas Fairbanks in "Reaching for the Moon." To the left may be seen the frames of truss-work supporting the Venetian houses.

How Motion Pictures Are Made

BY
HOMER CROY

Author of "BOONE STOP"

ILLUSTRATED



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BOOKS BY
HOMER CROY

BOONE STOP
HOW MOTION PICTURES ARE MADE

HARPER & BROTHERS, NEW YORK
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HOW MOTION PICTURES ARE MADE

HOW MOTION PICTURES ARE MADE

I

DAWN

SUCH is human nature that no sooner is a revolutionary invention perfected and put on the market than attempt is made, while the world is marveling, to show that the invention existed in other form long before the acclaimed originator began his experiments. Nothing gives such critics quite so keen and satisfying a pleasure as to show that the machine that has aroused admiration is but a modern working of a principle long known to mankind. Such love to explain that there were telegraphs before Morse; telephones before Bell; reaping-machines before McCormick; sewing-machines before Howe. As a result it was with pardonable amusement on his part that the author noted when the head-lines carried announcements of the employment by the British armies of caterpillar-crawling "tanks," that some one came forward to prove that Cortez had used them in his conquest of Mexico in 1520.

It is for these that we must go back and trace

HOW MOTION PICTURES ARE MADE

the gradual dawn of the idea of motion pictures, and it is for these that we must discuss the first machine that depended for its interest on the idea of continuous motion. The machine in particular was "The Wheel of Life," which made its appearance in England in 1833—an object of interest only to the nursery. It consisted of a hollow cylinder, with drawings on the inside which, viewed through slits in the upper part of the cylinder while it was rotating, gave the idea of continuity of motion. The painted representations on the inner surface of the cylinder showed a horse galloping, a figure dancing, or any animation that suited the fancy of the artist. By revolving the drum and peering through the apertures one was able to get an illusion of motion. The horse, by virtue of the different positions given it by the artist, seemed to rise and fall, the rider rhythmically rising and falling with it. To one willing to demand little in the way of naturalness, and to one satisfied to see a horse standing in one position suddenly attain another several yards away without intermediate progress, the cylinder held limitless hours of entertainment. However, to the more critical it was but a toy worthy of only a few passing observations—an object so simple in structure that a duplicate of it could be made in a morning by a person with a few tools at his disposal.

From this some have held that motion pictures sprang, which would be about as true and as adequate as saying that the Hoe printing-press sprang from a boy's set of type, for before The Wheel of Life was the school-boy, pad, and pencil—objects

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that have made many a school-room brighter, with their pictured representations of the teacher or of a dog chasing a boy. Movement was given to the latter by drawing the animal in fevered pursuit of the terror-stricken youth in pencil outlines on the bottom of the tablet and letting the pages slip from the thumb rapidly enough to give the idea of continuity of motion. To the school-room and its pad one might just as well give the credit for having originated the motion picture as to the nursery with its wheel and erratic horse.

No sooner had The Wheel of Life made its appearance than dozens of other toys on the same model sprang up over England. A father with an inventive turn of mind and a couple of sons to amuse would construct a toy that had achieved its purpose when it had kept his sons quiet for a rainy afternoon. One that attained more than local notice was a drawing of a bird-cage. Superimposed on this was another disk of paper with a dozen pictures of a bird drawn on it. Both disks were pierced by an axis. When the top disk, with the birds drawn on it, was rotated fast enough the birds seemed to fly into the cage. The upper disk was thin enough for the cage on the second disk to be seen through it, and by covering the part of the disk immediately back of the cage with a third superimposed segment of a disk the idea was given credence that the bird was flying into the cage. Since the segment was opaque, the idea of continuous flight was given—at least to a person whose power of imagination had not been damped somewhat by the world of actuality and realism.

HOW MOTION PICTURES ARE MADE

These rainy-afternoon diversions sprang up all over England and were given any fanciful name that happened to come into the mind of the inventor. Often it seemed that more ingenuity had been expended on the name than on the apparatus, for among the appliances for giving the idea of motion were the Dædaleum, the Thaumatrope, the Stroboscope, and the Kaleidorama, to say nothing of the Phenakistoscope.

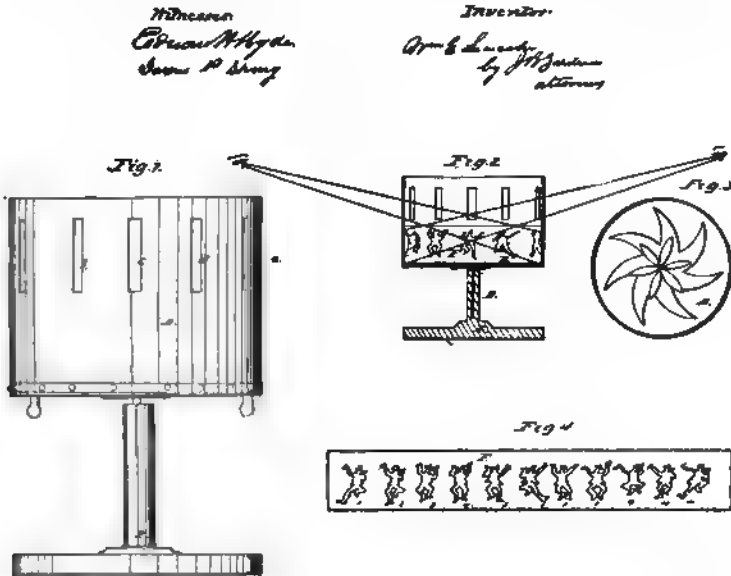
In 1845 The Wheel of Life was brought to America and this country turned eagerly to the problem of making the birds fly and the horses gallop by turning a spindle. Just as ingenious were our people as were the English in thinking up unusual names for their toys, for there soon appeared on the market the Anorthoscope, the Motorscope, the Vibroscope and the Zoetrope. Of these only the Zoetrope was to play any part in advancing the motion picture. It was invented first by Desvignes in France in 1860, but was duplicated in name, if not in intention, by one of our own countrymen, William F. Lincoln, of Providence, Rhode Island, who in 1867 took out a patent covering its principles.

The principle involved in it was somewhat analogous to that of all the toys of the period. The drawings from the letters patent are herewith reproduced. Fig. 1A is the cylinder, which, standing on a pedestal, may be revolved at will. On the inside of the cylinder are drawings representing a man in the pronounced movement of the Irish jig. His interpretation of the dance is seen by peering through the vertical slits in the cylinder after the

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manner shown in Fig. 2. It had served its purpose when it had held the wandering attention for a few moments.

One of the many fathers who experimented with The Wheel of Life toy to amuse his sons was a



THE ZOETROPE, THE FORERUNNER OF MOTION PICTURES

By revolving the cylinder and looking through the apertures at the top the figures seemed to move. This machine was the invention of a Rhode Island man.

doctor in Philadelphia who was put to it for a rainy-day diversion. Up to this time only drawings of objects in motion had been used—the penciled outlines of a horse galloping, or a bird flying, or of a bear dancing. The doctor in his experiments hit on the idea of making photographs of real people and showing them in action. In particular, he wished to show his two sons, Coleman, Jr., and Horace, in action. His special and par-

HOW MOTION PICTURES ARE MADE

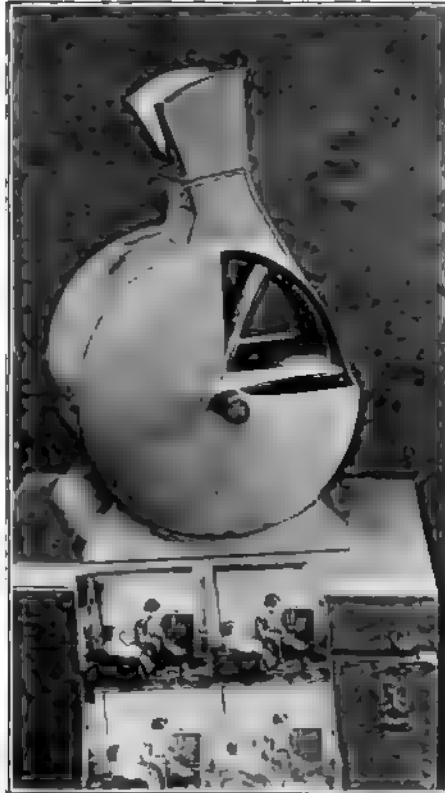
ticular desire was to show them in some characteristic pose. The two sons were much given to juvenile carpentry, so of them he made photos which showed Coleman, Jr., pounding while Horace rocked slowly back and forth. In making the requisite photos the doctor met an obstacle that nearly defeated his plans. As soon as he had made one plate he would have to make another before the boys moved. In doing this he found that the plates he had just made with care would dry before he had time to develop successive poses. In overcoming this obstacle he perfected the glycerine bath which has made every photographer, professional or otherwise, indebted to him, for by means of his glycerine bath a plate will not dry in the interval between exposure and development.

He had started out to entertain his sons with a revolving toy and had ended up by inventing the glycerine bath. Now that he had photographs illustrating successive phases of action, he had no way of giving them the semblance of motion. To the invention of such a machine he set himself, seeing, as he went deeper into the subject, that the toy as yet developed would not answer his requirements. As yet perfected it showed only the objects moving continuously, without any intermediate cessation, such as in the steady, unhindered revolving of a wheel. As he studied the problem he came to the conclusion that the object to be viewed must be at rest for the brief period that the eye gazed at it. On this principle he started anew and invented the "Kinematoscope," as he promptly christened it, unable to resist the temptation to

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give his invention a profound and inspiring name. This was the first patented invention to produce the illusion of objects in action. His patent was registered at the Patent Office in Washington, February 5, 1861, and so stands. The number of the patent is 31,357 and a copy of it may be obtained by any one so minded by sending the Commissioner of Patents five cents in cash. Stamps will not be accepted, probably governmentally inspired by the fear that they may be stuck together.

The Kinematoscope contained an eyepiece with the regulation stereoscopic lenses. Inside the box was a revolving set of blades something akin to the dash in a circular churn. On each of these terminals he placed a photo with a similar picture behind it, but show-



THE KINEMATOSCOPE

Invented by Doctor Sellers, of Philadelphia, during the Civil War and used to show photos of his sons in motion. This was the first machine to give illusion of real people moving. The photographs were viewed through the stereoscopic hood above.

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ing a slight advance in action. The particular scene he showed was his two sons in the nursery. Coleman, Jr., was hammering a nail while Horace rocked. The picture as made by the collodion process is herewith reproduced, showing how the scenes were made in duplicate. Before being placed in the machine the pictures were cut apart. The two lower duplicates were placed so as to be the first to appear to the eye, with the two in the middle next and the two at the top last, thus permitting the eye to follow the stroke to its completion. A little experimenting showed that a better illusion could be secured if three photos were made of the hammer at the beginning of the stroke and two at the middle, with one illustrating the hammer achieving its purpose. Arranged in this order they better conveyed the increasing swiftness of the stroke.

The photos were put on a circular dash and the whole revolved by means of a wooden knob. Peering through the eyepiece, one saw for the first time an animated nursery scene depicting Coleman, Jr., busily engaged in hammering a nail while Horace, too young for the demands of such strenuous activity, contented himself with the more juvenile pastime of rocking and looking on. The two sons who posed for this picture are still living; Coleman, Jr., is president of William Sellers & Company, a large iron and engineering concern in Philadelphia, while the boy who so complacently rocked and looked on is now a bearded architect in the same city.

For the first time was understood by the inventor

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the principle that gives the illusion of motion. Before this not one of the scores of inventors who had turned their attention to pictured motion had come to the bottom of the problem. Until this time the mechanism conveying the pictures had



THE FIRST PHOTO EVER MADE TO SHOW MOTION

It was made in Philadelphia in 1861 and the two boys who posed for the picture are still living.

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been in continuous motion. Doctor Sellers was the first to arrive at the conclusion that the movement should be intermittent. He was the first to determine that the picture should be at a period of rest while it was before the eye.

The whole illusion of motion pictures depends on seeing pictured representations of objects in such rapid succession that the image of one does not pass from the retina of the eye until the next picture has made its appearance. To understand what the early inventors were working toward we will have to understand the illusion of the motion picture, and by understanding it we can better trace the steps that led up to its achievement.

In the early experiments it was found that when the movement of the pictures was continuous there was a blurred effect similar to the revolving of a spoke of a wheel before the eye. Each picture was not sharp. The image was found to be clear if it stood still for the fractional part of a second and then moved on. If the pictures came rapidly enough, and if each one expressed a slight advance in action, such as the swing of the arm of the boy hammering, then an observer got the idea of continuity of motion. But the more important part was that the picture must stand still for the fractional part of a second. The more quickly the picture was withdrawn and the more rapidly it was replaced by another showing a slight progression in movement the more complete was the illusion of actually seeing the object in motion.

Doctor Sellers was the first to discover this, but he did not avail himself of it. Instead he changed

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the course of direction of the moving object; instead of having the object move across the vision from right to left, as had been the common practice, he had it come up from the bottom so that the eye could comprehend it before it disappeared from sight. This was later brought out in his application for letters patent, which reads:

After a long series of experiments, I made the discovery that it is absolutely necessary that the picture should be entirely at rest during the moment of vision, or that the motion should be in the direction of the line of vision; that is, advancing toward the eye, or receding from it; just as you would take a card in your hand and move it rapidly to and from you, in contradistinction to moving it from right to left or up and down.

As a result Doctor Sellers did not employ what is now known as intermittent motion, using instead the up-and-down movement, with the result that the object of interest was longer in the vision than if it had progressed from right to left.

Doctor Sellers then stated for the first time the one absolute requirement in securing the effect of motion:

It must be done by showing a succession of pictures (taken in different positions of the moving object) with sufficient rapidity to insure the image of one being retained on the retina until the next is brought into view.

He not only knew why moving pictures gave the idea of continuity of motion, but also knew that the pictures should be at rest during the moment of vision. The latter he did not attempt, however, getting the same effect by having the pictures come up from below in the direct line of vision, securing

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the effect he wished without the elaborate equipment necessary to produce intermittent motion.

When it is taken into consideration that the first mechanisms that faintly approached the reproduction of motion were merely toys with drawings so arranged on cylinders that by revolving them and letting the drawings pass before the apertures from which the eye gazed at them, then the length of this step forward is apparent. However, with Doctor Sellers, it seemed the final step rather than the first on the path that grows more wonderful with possibilities with each succeeding year. That he was able to show actual people in motion, and to understand the optical illusion by which it was accomplished, was all that interested him. The plaything lost its interest to him and, dropping it, his ever eager mind attacked the problem of finding a better dressing for wounds than that offered by lint, with the result that he was the first to demonstrate to the world the value of absorbent cotton.

Now that the principle of *persistence of vision* had been given to the world, it was only a matter of months until inventors on both sides of the Atlantic were experimenting with the phenomenon that seemed to offer no more possibilities than those offered by an ingenious toy. One of the experimenters who understood clearly the principles behind motion pictures was Ducos, of France, who, three years after Doctor Sellers had patented his stereoscopic machine, obtained a patent under the French laws and clearly stated in his application the principle on which he was working. The text of what he accomplished merits reproduction:

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My invention consists in substituting rapidly and without confusion to the eye, not only of an individual, but when desired to a whole assemblage, the enlarged images of a great number of pictures taken simultaneously and successively at very short intervals. The observer will believe that he sees only one image, which gradually changes by reason of the successive changes of form and position of the object which occur from one picture to the next. Even supposing there be a slight interval of time during which the same object was not shown, the persistence of the luminous impression upon the eye will fill the gap. By means of my apparatus I am enabled especially to reproduce the passing of a procession, a review of military maneuvers, and, if so desired, the grimaces of a human face.

It is interesting in this day of high salaries to motion-picture stars to note that to the French inventor the last and most doubtful use to which animated pictures could be put was to reproduce the grimaces of the human face. They were especially recommended to reproduce the passing of a procession or a review of military maneuvers, and then, if one was so minded, he could take a picture of a person and show that, too—if any were to be found who would be interested in it.

With the cessation of Doctor Sellers's work, stereoscopic appliances came and went with the regularity of seasonal toys, leaving behind half a hundred 'scopes and 'tropes, gaining in renown in proportion to whether they were invented and given to the immediate nursery or offered by adventurous manufacturers who had faith that other children also would be amused by the antics of a dancing bear or of a lion chasing an unfortunate pedestrian.

No serious work was accomplished and no steps

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forward were taken until the year 1872, when, curiously enough, an argument started among some horsemen in California that was to have a startling effect on the history of the world. These horse-owners, in discussing the gait, thrust, and toss of their respective animals, came to words as to whether or not a racing-horse had all its feet off the ground at the same moment. So provocative and personal did the argument become that the men decided to make some experiments to settle the controversy. Among those who participated in the argument, but not a horse-owner himself, was Edward Muybridge, an Englishman employed by the United States government in making a geodetic survey. To him they appealed to make photographs, considering them a means that would register motion which could be studied at leisure, when the argument could be settled once for all. Muybridge, bringing out his camera containing the wet collodion plates (for the dry-plate process was not then perfected), set it up at the Sacramento race-track and made his exposures. A few experiments demonstrated that to arrive at any accurate results he would have to employ more than one camera, so, from the pool made up by those immediately concerned he purchased twenty-four cameras and placed them at the edge of the race-course, conveniently close together, with a fine thread attached to the shutter of each camera and stretched across the race-track so that the horse in passing must needs break the string, which would release the shutter and make an exposure on the sensitized plate. The next camera would show an ad-

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vance in action, with the result that by the time the animal had made the distance in front of the twenty-four cameras he would leave a fairly accurate record of himself on the plates which could be studied at leisure. However, when the first exposures were made it was found that the speed of the animal blurred the plates so that it was not always determinable whether or not the animal's hoof was actually on the ground. To offset this photographic obstacle a fence was built immediately in front of the battery of cameras and painted black. With the brilliant California sun shining on this and taken against the light, silhouettes resulted, with the details happily distinct.

Surprised at the result and enthused at how, for the first time, one could see the exact movements an animal went through in securing locomotion, Muybridge went to Leland Stanford, Governor of California and a horseman of both enthusiasm and means, and interested him in his experiments. Governor Stanford came up to every hope held by the photographer and agreed to furnish him the financial means by which he could continue his animal studies. A studio was built by the side of his own private race-course at Palo Alto, where now stands Leland Stanford University, and in it were housed the twenty-four cameras. Here day after day Muybridge conducted his experiments.

There were many obstacles to overcome and much to learn, not only about photography, but about showing the pictures in such a way as to get the desired effect.

Now that he had succeeded in taking twenty-four

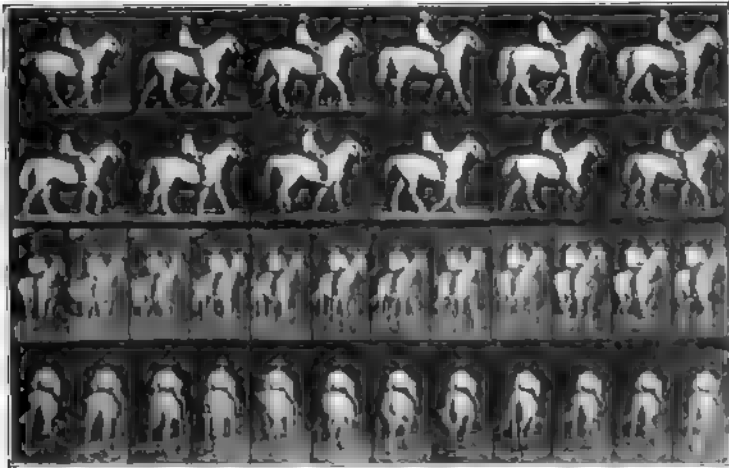
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pictures in succession of a rapidly moving object, how were they to be projected? To this Muybridge set himself, with the result that he achieved a machine that would throw a projection of the glass plates on a screen. Promptly, and in accord with the spirit of the day, he called it the "Zoo-praxoscope," thereby making sure that none of his predecessors had outdistanced him in at least originality of nomenclature.

This machine, more inspiring in name than in results, consisted of a large glass disk with reproductions of the photographs set along its margin. On this were pasted as many successive phases of an action as wished, each showing a slight progression in movement. An oxy-acetylene light was set up with a condensing lens which would project the picture on a screen. But, as was discovered, if the glass disk was revolved naturally the pictures cast on the screen would be a blur. To give a sufficient lapse between each advance in action, a second disk was placed in front of the glass one containing the photos. This was also operated by a spindle—in particular a tubular shaft inclosing the smaller one which operated the glass disk so that the movements of the two disks would be individual. The second disk was not of glass, as might be supposed, but of metal. Running from the margin toward the axis were perforations at suitable intervals. When the two disks were revolved—one in one direction and one in the other—the light threw on the screen an enlarged image of the picture on the glass disk at the moment the aperture in the metal disk coin-

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cided with the picture on the glass disk. It would flash for a fractional part of a second and then be cut off by reason of the revolving disks, when immediately another would flash showing a slight advance in action. Thus by watching the pictures



MUYBRIDGE'S STUDIES IN ANIMAL LOCOMOTION

These were taken by a battery of twenty four cameras, each exposure showing an advance in action. These studies were made at Palo Alto, California, and later at the University of Pennsylvania. The fence was painted black so that the horse and rider in white would stand out in relief.

on the screen the idea of motion was conveyed by reason of persistence of vision.

Pictures attaining anything akin to action were thus projected on a screen for the first time. The work showed a marked advance over Doctor Sellers's in two ways: The photographs showed rapid action, and the machine projected the result on a screen. Until Muybridge's revolving disks, each person had been his own audience; now a number of persons at the same time could avail themselves of a demonstration.

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In 1878 his experiments were published, creating wide-spread interest both in Europe and in America, especially among artists who had always been at a loss to know the exact movements gone through by an animal in locomotion. No sooner had the result been published than there was an immediate demand for Muybridge to appear in person before scientific bodies to tell in person how he had made his pictures. His first appearance in Europe was in the laboratory of Dr. E. J. Marey in 1881, where he was listened to by many of the foremost scientists of France. Especially interested was Doctor Marey, who later was to become a factor in perfecting the motion picture.

On his return to America Muybridge was approached by the officials of the University of Pennsylvania, who offered to equip him not only with a studio, but also with means, that he might continue his experiments. He accepted this offer and promptly for him was built a studio one hundred and twenty feet in length, and there he again took up his experiments. Much of his work was conducted on what has since become Hamilton Walk of the University Campus.

He had gone but a little way with his work when he found that to attain anything like the results he desired he would have to find a quicker way of taking exposures. To the solving of this problem he gave himself, with the result that he took the first instantaneous photographs in history. So expert did he become in the taking of rapid exposures that many of the pictures he was able to take at an exposure of one six-thousandth part



AWARDED TO MUYBRIDGE AT THE WORLD'S COLUMBIAN EXPOSITION IN CHICAGO, 1893, FOR SHOWING PICTURES OF OBJECTS IN MOTION
 Muybridge's discovery was classified, not as motion pictures, but as photography illustrating animal locomotion.

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of a second. Even to-day, after all the years have elapsed, shutters no more rapid have been devised.

With the setting up of his studio at the University he gave less time to the taking of the pictures of horses and devoted his attention to the college athletes. In various positions of rapid motion he photographed the University athletes and then turned his attention to animal movements, photographing and analyzing the movements of the raccoon, the baboon, and the sloth, as well as the movements of the folds of skin on a hog's back.

Not content with having a number of photographs made by an equal number of cameras, he succeeded in making twelve exposures on one plate.

Working in conjunction with Dr. Edward Reichert, now Professor of Physiology at the University of Pennsylvania, he succeeded, in 1887, in making the first instantaneous pictures in medical research. The pictures in question showed the beating of a dog's heart. After giving the dog an anesthetic, the chest of the animal was opened and the camera posed in such a position as to show the successive phases of the dilation and contraction of that organ. When these were placed in his Zoopraxoscope and projected on the screen a fairly accurate idea of the action of the animal's heart could be obtained, thus establishing a record, chronologically, for moving pictures displaying the movements of any internal organ, whether animal or human.

The work of the aged inventor continued—the University making different appropriations until \$40,000 was granted—until 1893, which, as subsequently revealed, was an important year in the

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history of motion pictures. This was the year of the World's Columbian Exposition, better known as the Chicago World's Fair, which brought together the most advanced achievements in all lines of human endeavor. At the Exposition, Muybridge was invited to exhibit and to Chicago he brought twenty thousand original photographs and his machine for projecting them. The pictures dealt chiefly with animal movements, although some attention was paid to persons afflicted with locomotor ataxia, lateral sclerosis, and kindred diseases, and were viewed by men of science from all over the world. In recognition of his stimulation of thought in this new and promising channel, the Commission awarded him a certificate of honor for photographs illustrating animal locomotion, the award reading:

The photographs made by Mr. Edward Muybridge, under the auspices of the University of Pennsylvania, show with great elaboration and precision the locomotion and movements of animals, including man.

With this, Muybridge's work was practically ended. He was now an old man, having given up more than twenty years of his life to advancing the cause of pictured motion. He had succeeded in taking instantaneous photographs and in projecting them on the screen so that the idea of continuity of motion might be conveyed to the observer. The motion was crude, jerky, and spasmodic, but it was—and that was the important part—motion. He had taken a toy and made it envied and respected by men of science the world around.

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It was to him that the first vision of motion pictures appeared. He was the first to recognize that the present means was merely a makeshift. So strongly did he believe in the possibilities of cinematographic motion that on February 27, 1886, he went to Edison, the inventor of the phonograph, and asked if his own Zoopraxoscope and the phonograph could not be synchronized so as to give the illusion of the characters speaking. Edison explained that he had not yet perfected his machine to where the sound was of sufficient volume to be audible to a large gathering, and, acknowledging this for himself, the aged inventor, Muybridge, went back to his studio with the idea of synchronized pictures abandoned.

Even outside the field of motion pictures his achievements are of value to us, for his book, *Animals in Motion*, is still used by artists in their studios as an authority on the subjects treated. It might be mentioned also in passing that his photos established that a racing horse going at a certain rate of speed was at successive points in his stride clear of support, thus settling affirmatively the argument of the California horsemen.

Inspired by Muybridge's work, Dr. E. J. Marey, in France, took it up practically at the place abandoned by Muybridge and carried it on to still further scientific attainments. For it will be noted that the interest felt in pictured motion was scientific rather than of an amusement nature. It was not until years later that its possibilities as a means of entertainment were realized.

Marey, in studying the many problems that



EDWARD MUYBRIDGE, THE GRANDFATHER OF MOTION PICTURES

He spent twenty years of his life working on them—and yet the honor of perfecting them was to go to somebody else.

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animated photography presented, arrived at the conclusion that the illusion of motion would never be perfect as long as the object was seen from different angles. As presented by Muybridge with his twenty-four cameras it was as if twenty-four pairs of eyes were looking at a moving object and presenting to one brain their individual efforts. Marey decided that the pictures must be taken from one point of view, and to the perfecting of such a camera he devoted himself, with the result that in 1882—one year after Muybridge had lectured in his laboratory—he announced the invention of the Marey Photographic Gun. From a single lens he was able to take the requisite number of exposures per second. When these were thrown on the screen, all taken from one coign of vantage, the illusion of motion was more perfect. But there was still something lacking—something missing to make the illusion complete. As we go along we shall see what this was.

To project his glass slides an elaborate equipment was required, and even then only a few phases of a movement could be shown on the screen by reason of the quantity of slides necessary.

However, Marey's contribution to the advancement of the motion picture—a camera that with one lens would take exposures with sufficient rapidity—was a valuable one, and gravely he named the art of his new discovery, "Chronophotography."

II

HOW THE FIRST MOTION PICTURE WAS PROJECTED

IN the struggle to produce motion in pictured form, something was holding the inventors back. None knew what it was, but all realized the inadequacy of their efforts. Years had been spent and thousands of dollars had been invested trying to animate bygone scenes, and all there was to show for it were a few revolving glass disks which gave a moment's wonder and then a severe headache.

The movements of the characters on the screen were so spasmodic and so jerky that only the more generous could see in them a semblance of life. Even to show such a simple act as a horse galloping meant a formidable box for transporting the plates and an elaborate machine for projecting them, with a pretty definite assurance that the machine would break down before the animal had achieved its goal. Muybridge had spent twenty years of the best part of his life and yet could reproduce nothing more complicated than a monkey contorting itself in response to a barrel-organ.

Inventor after inventor grappled with the problem, but none could advance it further than Muybridge had done. When Muybridge published his first reports, scientists in both Europe and America

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seized the volumes and tried to perfect the work, but without avail.

Gazing at the Zoetrope one day, Thomas A. Edison saw possibilities beyond that of the crude representations of the bear dancing which could be brought out by revolving the cylinder. As he gazed at the rising and falling drawings it flashed over him that by some means a real bear ought to be made to perform. At once he saw that some more complicated machine would have to be the intermediary between the observer and the object viewed, and that instead of drawings real photographs would have to be used. To the solving of this he set himself, but after a few preliminary experiments he abandoned them. The idea lay dormant in his mind until it was revived again by the experiments of Muybridge and his revolving wheel with the photographic plates set in its margin. He saw at once that Muybridge had made an advance and in his own mind he felt convinced that Muybridge had done all that could be accomplished with glass plates. The trouble with glass plates was that they could not be progressed in front of a projecting light at a speed fast enough to give the idea of motion. The images on the plates were sharp and clear and each showed an advance in action over the preceding one, but the pictures did not keep the same point of view. It was as if twenty-four eyes were watching an object passing, and reporting what they in turn saw. Revolving the problem in his mind, Edison came to the conclusion that the pictures must be taken by one camera, but as his interest was principally in the

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talking-machine he finally abandoned his experiments without having achieved anything of permanent value. With the appearance of Marey's Photographic Gun he was spurred on to new interest in pictured motion. In 1886 he conferred with Muybridge to see if there was not some way by which his own talking-machine and Muybridge's Zoopraxoscope could be combined to show a person moving and speaking at the same time. It was decided that neither machine was far enough advanced in its own field to make synchronization of them feasible and thus the project was abandoned.

Later Edison returned to the perfecting of motion pictures with renewed energy, elaborating his idea of taking pictures with one lens instead of with a battery of cameras. The perfecting of the idea meant not only the building of a camera to take pictures, but also the perfecting of a machine to project them. To this he set himself, believing that the machine should be one and the same and that by a reversal of the lens and a few minor changes the machine could perform both tasks. He had determined, from studying Muybridge's experiments, that it was useless to try to take the pictures on glass, so to finding a substitute for glass he devoted himself. His first determination was that the substitute should be light and flexible, so that it could move in front of a central lens easily and rapidly. There was on the market no such substitute, and to the making of this he gave his attention, making in his laboratory a film by rolling it under glass cylinders until it approached something near an even thickness. With his own films thus made by the crudest

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of methods he continued his experiments. He was thus able to produce a flexible collodion strip and from him other experimenters bought their film—for by this time others were interested in showing pictured motion.

For the photographing of moving objects Edison had invented a camera, and now he was at work on a machine to show the film thus exposed. With characteristic zeal he applied himself to the perfecting of his device, and at last announced that he was able to show pictures of objects in motion by means of a machine which, following the nomenclatural trend of the day, he called the "Kinetoscope." It would show pictures in motion, as he stated, but it was conceived on a principle that was later seen to be inadequate. To see the pictures on the film it was necessary for the observer to apply his eye to a stereoscopic enlarging hood and gaze into a dark box. This at the proper time was illuminated and the film set in motion. The film was drawn along, passing on its way a fixed light so that the observer looked directly at the pictures on the film. Thus seen, even under their magnification the pictures were little larger than postage stamps. Only one person could view the pictures at a time. Even when thus viewed the pictures were so small as to have little semblance of a living person. The idea of throwing pictures on a screen by means of an intermittently moving film had not yet been hit on.

By some play of fate he worked on the wrong principle. He stepped off on the wrong foot. Instead of trying to perfect a method of showing the

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pictures on a screen where they might be viewed by an audience, he bent his energies to perfecting a device where only an audience of one could see the new photographic wonders. If it had occurred to him to exhibit the pictures on the wall where they might be viewed by many instead of one, and had he given himself to the working out of this principle, he would have been the inventor of motion pictures, but instead of that the honor was to go to another.

From Edison the early workers procured their film, but the film was rough, uneven, and wholly inadequate for the fine work demanded of it.

Experimenters in different parts of the United States came and went, all going up against the impenetrable stone wall that blocked their way—an adequate medium for the reception of their photographic exposures. Edison, manufacturing the film for his own use, cared little for the open market. Slowly the scene of activity in this new field of reproducing pictorial animation was swinging from Philadelphia, where Muybridge was working, which for so long had been the home of hope, to Rochester, where a man without the slightest interest in motion pictures was doing more for it than any other person. He had set himself another task, but unconsciously and unknown to himself he was solving a problem that was baffling a score of inventors. The problem before him was to get some better means of reproducing pictures than that of unwieldy glass plates. George Eastman was the man, then a small but industrious manufacturer of dry plates. Looking into the

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future, he saw that the art that interested him most could not advance to any degree of universality as long as retarded by bulky glass plates. A lighter substitute was his ambition, and on gelatine he pinned his hope, to find that it could not stand the demands of the developing solution. Convinced that gelatine alone would not meet all requirements, he tried a transparent paper which he covered with an emulsion, believing that at last his troubles were over. The transparent paper was successful as a support for the emulsion, but the grains of the paper obfuscated the positive to such an extent that it was abandoned.

These substitutes failing one after another, celluloid was at last hit on by the Rev. Hannibal Goodwin. It was light, transparent, and flexible. However, this last feature, which has proved to be the greatest single factor in the development and popularization of photography, seemed at the time of no special consequence. In fact, it seemed to be a drawback. The flexible film was now wound upon one spool and drawn down to another, passing on the way the lens where the film might be exposed at the will of the operator.

In 1890 Eastman announced that he was prepared to sell flexible film. The announcement, Eastman thought, would be of interest only to photographers, but instead it was of more vital interest to an entirely different class of men. The inventors now seized upon the film as being the missing link.

With the flexible film perfected, it was now a race between inventors. All parts were at hand. The

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principle of persistence of vision was now thoroughly understood; instantaneous photography had been developed so as to be able to reproduce the quickest of movements. Electricity had come in, so

(No Model.)

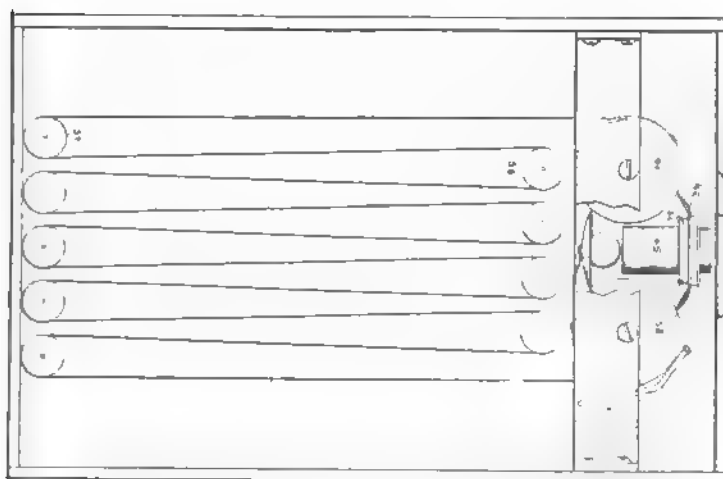
T. A. EDISON.

4 Sheets—Sheet 2.

APPARATUS FOR EXHIBITING PHOTOGRAPHS OF MOVING OBJECTS.

No. 493,426.

Patented Mar. 14, 1893.



Witnesses
Thomas A. Edison,
J. B. Clark

Inventor
T. A. Edison
By John B. Clark
Agent

THE "KINETOSCOPE" INVENTED BY THOMAS A. EDISON IN 1893

This was the first machine employing film to be used to show pictures in motion. Here the observer looked directly at the film instead of at the screen as we do now

that a sufficiently bright illumination could be used in showing the pictures. It was now a matter of assembling. The race soon settled down to a contest between Thomas A. Edison and C. Francis Jenkins—the latter name appearing for the first time in cinematographic history.

The same problem confronted each inventor. He

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must not only take his own pictures, but he must also invent a process whereby the pictures might be exhibited on the screen. Patiently each went to work in his own way to perfect a machine to expose small areas on a sensitized negative in quick succession, while the film should move by a single recording lens. The satisfactory solving of this problem did not mean the successful exhibition of animated pictures, for yet to be solved was a method of exhibiting them in such a way that the observer or observers might get the idea of motion.

The Kinetoscope which Edison invented March 14, 1893, was a coin-actuated device. By dropping a nickel in the slot and applying one's eyes to the pair of enlarging lenses one might see an actress in the mazes of the serpentine dance. But the audience could consist of not more than one person. The film was advanced from left to right by means of a motor, and while the film was in front of the aperture the figures were made visible by an electric light just behind the film. The light revealed the postures of the dancer as she appeared on the "frames" in front of the viewing aperture. "Frame" came to be the word used to designate the small picture on the film, the picture itself being scarcely larger than a postage stamp, and will be so used in this volume without further explanation. The light was obscured as the frames passed by means of a revolving metal disk with calculated apertures left for the viewing of the picture.

The film, pieced together until it was something

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like forty feet in length, was stretched tight in an endless belt over a number of pulleys, as may be seen in the accompanying illustration. After it had made one complete round it came to rest at such a point that the depositing of another coin would not only start the film on its circuit again, but would also begin the story anew.

Hardly had the Edison machine been completed in 1893 than the Chicago World's Fair opened its gates and people from all over the world availed themselves of the opportunity to see the wonders therein.

On exhibition in Zoopraxical Hall were the pictures taken by Muybridge and imposed on glass disks, as explained, which gave the idea of motion—Zoopraxical Hall being the name Muybridge gave to dignify his place of exhibition and to indicate the wonders that might be viewed behind its doors. A few buildings further down even more wonderful moving pictures might be viewed on the depositing of a nickel, but here instead of having them thrown on a wall one had to bend over and apply his eyes to a small peep-hole. From this means of viewing the pictures the machine took a name that followed it for years in the profession—that of the Edison "Peep-hole" machine. One had now the choice of watching on a white expanse of wall the effect of disks revolving, or of applying one's eyes to a pair of enlarging lenses and seeing a serpentine lady flit by in mystic mazes of the dance then so popular. The latter was the one that brought the crowds. With the showing of the film with its superior illusion meant the passing away of the

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revolving-disk machine. Its interest from then on was merely historical.

At the closing of the Exposition in Chicago, four of the Edison machines were brought to New York and placed in a penny arcade on the west side of Broadway at Twenty-eighth Street, where in December, 1893, New York got its first glimpse of animated motion.

With the showing of the Kinetoscope in Chicago, the secret of the motion pictures was given away to the world. The idea was sown afresh. Thought was again stimulated. Among the interested observers were two gentlemen in the amusement business in London. No sooner had they seen the peep-hole machine than they realized that here was something that would be of interest to English audiences. Purchasing one of the machines, they took it back to London and bore it to a mechanic who had more than local fame for skill in his craft. They asked him to duplicate the machine. Investigating, Robert Paul found that the machine had not been patented in England, and complied with the showman's requests. Securing the machine, the showmen went on their way. Since these men were so eager to get their machines, Paul reasoned that there must be others equally eager. To the task of making further duplicates of the machine he coolly set himself, finding an immediate market for all that he could make. Not only to local pool-rooms and penny arcades did he sell them, but to showmen from other parts of the world, until it was not long until he was selling machines in Australia, New Zealand, and even in Japan.

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When his activities came to the attention of the Edison interests, they endeavored to frustrate his efforts by despatching agents to London instructed to buy up all the celluloid film that had been sent over. This they did, hoping thereby, since celluloid was only manufactured in America, to preclude further manufacture. Suddenly the purchasers of the Paul copy found that they could buy no film. They had a boat without an oar. Paul found himself in an awkward plight, for daily demands were coming in for the orders he had accepted, but these he was unable to fill. Among those who were thus delayed was Charles Pathé, of Paris, a small showman across the Channel, who later came to head the world's premier film company.

Casting about for a method of extricating himself and appeasing the clamoring purchasers, Paul gave up the manufacture of machines and settled down to the making of film. Now thoroughly started on a career of animate photography, he attacked the problem of constructing a better taking machine and after a number of experiments completed a machine that involved the principle of intermittent motion. This resulted in much better and clearer pictures, but as he studied the problem he realized more fully than ever that the big problem was projection. The two, hand in hand, were common stumbling-blocks, but now the one that assumed gigantic proportions was one of projection. He saw that there must be some method of showing the pictures so that more than one person could view them at the same time. To the solving of this he set himself, and to it, also, he

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applied intermittent motion. His efforts were rewarded by success. On the twenty-fifth day of March, 1896, three years to a month after Edison had completed his peep-hole machine, Robert Paul projected forty feet of motion-picture film depicting "A Rough Sea at Dover" on a screen at the Alhambra Theater in London. He was taken up by the nobility and his efforts widely acclaimed, becoming for a time a social favorite with, as so often happens, no inquiry as to his means or methods.

Although loudly as he was hailed as the inventor of motion pictures, he was not, as we shall see as we go along. To him cannot even be given the honor of having perfected the first intermittent projection—a point also to be brought out later.

Coincidental with the hurrying of an Edison Kinetoscope to London another also went to Paris, where it was brought to the attention of Lumière & Sons, a concern manufacturing with noteworthy success dry plates and photographic apparatus. Seeing its value as a means of entertainment and yet realizing its imperfections, they set to work to bring it up to where it would be commercially valuable. Working independently of Paul—so industriously copying the Edison machine in London—the Lumières started in to correct the faults of the Kinetoscope. Their attentions were directed to producing intermittent motion, and in this they were successful about the same time Paul in London was able to exhibit his, however with the additional advantage that theirs was a superior machine. Intermittent motion they secured by a steel finger that reached up, caught

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in a perforation in the margin of the film, and pulled it into the desired place, the steel piece itself being somewhat in the shape and working after the manner of a button-hook.

Now with film and a machine to project it, Lumière found that he must have a brighter light. Experiments showed that only an arc-light gave the requisite illumination—and the arc burned the film. Something of a translucent nature would have to be interposed between the arc and the film, but what? That was the question: What would not intercept the light rays and yet retard the heat rays? After some weeks of experimentation he hit on the idea of using a special bottle filled with water. To this water was added a few drops of acetic acid, resulting in a clear white light. But an unexpected difficulty arose after a few moments of projection when it was found that the water began to boil, making bubbles which distorted the picture. An ingenious solution was arrived at by placing a piece of coke on a wire and inserting this beneath the surface of the water, which let it boil but yet eliminated the troublesome bubbles.

On completion, Lumière took the machine to London, expecting it to be regarded with wide curiosity, but instead it was viewed with little interest. Public interest had expended itself on the Paul machine which had been exhibited a few months previously.

Meantime all these exhibitions had been anticipated in America. One morning bright and early a young man with reddish hair, a stenographer in

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the Life Savings Division of the Treasury Department, got on his bicycle in Washington, D. C., when his June vacation came, and started out on a cross-country ride, one among the thousands who found delight in the then popular recreation. Westward he rode, finally bringing his journey to a close at Richmond, Indiana, where, by reason of the seven hundred and twenty miles that he had accomplished, he was the hero of the hour.

But a greater wonder than that of mileage he was to bring to them. The following day he unpacked a trunk that had preceded him and asked his parents and friends to come down to the jewelry-store, owned by his cousin, and see something that he had invented. Although the young man—C. Francis Jenkins—was a stenographer in the employ of the Treasury Department, they knew that most of his free hours were spent at the work-bench and that already technical-sounding papers bearing his name had been taken out.

All morning C. Francis Jenkins made ready to show his home friends the object that had been the center of his attentions for two years. Electric current he needed to run it, but in the store there was no electricity, the source of illumination being a large-bowled lamp. The only current in reach was the trolley wire that passed by the door. To the wire he attached a lateral and brought it down to the proper voltage by means of a pail of water. On the counter the machine was placed, while on the opposite wall a bed-sheet was hung. The window-blinds were drawn on passing customers at small financial risk, while the young man's father

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and mother and a number of friends and newspaper men stood in the half-light wondering what was about to be revealed to them.

The arc began to sputter and out from the wall stepped a girl clad in garments more picturesque than protective and began to execute the intricacies of the Butterfly Dance. The dancer in question was Annabelle, a vaudeville favorite of the day who had been engaged by the young inventor for one special performance in the back yard of his Washington boarding-house, with the audience consisting of himself and a camera. The lady's remuneration for interpreting the insect's terpsichorean movements had been five dollars, which seemed to cover adequately all the artistry displayed.

As the sputtering grew louder and the grinding more fervid, the girl began to reproduce on the wall the movements she had executed in the boarding-house back yard, lifting her skirts by means of a stick in each hand and waving them in fancied lepidopteral imitation, so far forgetting herself as to be unconscious of the height reached by her floating draperies. As the dance grew more intense the young man's mother began to grow correspondingly uneasy, turning questioningly to the young man's father, who seemed to be taking it with surprising complacency. Appeal as she might to her companion, the sputtering continued to grow louder and the dancing remained unabated, while the girl danced on, unashamed. Even though the boy's father did not realize the ruin that hedged his son about in Washington, the mother did, and with the convictions of her courage before her, rose

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up and hurried home for the purpose of prayer and meditation, while the less godly stayed to finish—thereby witnessing the first moving-picture exhibition in the world.

The arc ceased to sputter, the window-shades were rolled up, and the people began to ask one another what they had seen. It was not clear. There was no word to express it; the impression could be conveyed only by long and tortuous explanation. The original Annabelle they had not seen, that was clear. Behind the screen they went to see what the trickery was, but the wall was sound. It responded to no hollow thumps. The machine with the sputtering arc they examined, but it was open and aboveboard. The crowd broke up, not quite clear as to what had happened, but feeling convinced that if they could see another exhibition they could uncover its trickery. The parting of the crowd marked the first time, June 6th, 1894, that an assemblage had ever seen motion pictures as we know them to-day.

That evening *The Richmond Telegram* came out with the following head, announcing the event:

A GENIUS

C. FRANCIS JENKINS

FORMERLY A RESIDENT OF THIS CITY

HIS NEW INVENTION, THE PHANTOSCOPE,
THE MOST WONDERFUL EVER INVENTED
BY A WAYNE COUNTY MAN

In detail the account related what had happened, making no attempt to explain how it was



C. FRANCIS JENKINS

He was the first person to show motion pictures in the form we now know them, thus giving the honor of their discovery to America instead of to England. Mr Jenkins is now a manufacturer of projecting-machines in Washington, D. C.

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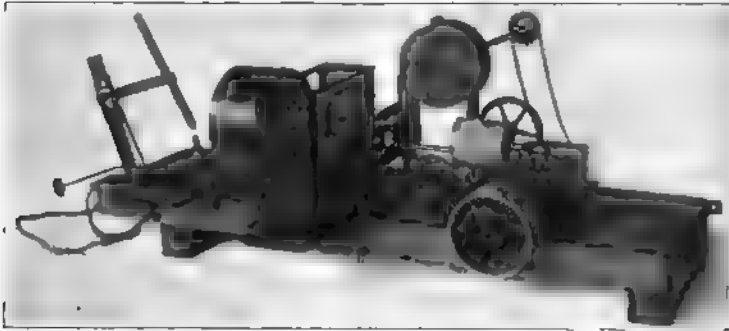
done, but with true Indiana conservatism it would not deal in extravagant phrase, holding itself to the non-committal announcement that it was merely the most wonderful invention ever put forth by a Wayne County citizen. Even though it was the first showing of motion pictures and an event of international significance, *The Telegram* would not allow its praises to go further than the confines of the county, showing by its conservatism that there might be inventors outside the county who had done wonderful things, but as to that the paper could take no editorial stand.

Not only was this the first showing of motion pictures, in the present acceptance of the term, but also it was the first exhibition of colored pictures. Laboriously the film had been stained by Mrs. Boyce, of Washington, each frame having been done with minute and painstaking care. The Japanese silk that Annabelle wore lent itself particularly to color and the opportunity was made the most of by Mrs. Boyce, who had been accustomed to coloring lantern slides. The color used was not pigment, which would render the film opaque, but a stain which offered no interference to the passage of the light rays.

The machine used on the occasion consisted of an arc at the rear, wholly unhoused, with the light passing through a round condensing lens. To keep the arc from setting the film on fire, the heat rays were eliminated by a water cell. The film was progressed by means of a toothed sprocket wheel, which passed it down in front of an aperture corresponding in size to the frame of the picture.

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Further down, the film was taken up by means of another toothed sprocket wheel. To the left of this lower sprocket wheel may be seen, in the accompanying illustration, a circular disk with a finger projecting out from it at right angles. As this turned around it struck the film at each revolution,



THE MACHINE THAT PROJECTED THE FIRST MOTION PICTURE

With this machine Jenkins at Richmond Indiana, projected the first motion picture in the form that we now know it. The machine is now on exhibition in the United States National Museum in Washington, D. C.

giving it a slight forward jerk which resulted in the necessary intermittent movement. This was known as the "beater" movement and was continued in use until superseded by the toothed sprocket rotated intermittently by means of a Geneva gear.

The film was made by taking rolls of Eastman film into a dark room and slitting it at the desired width. Even with a strip of film of small lateral measure the question was yet to be solved of how this could be progressed through the taking apparatus. The solution was reached by using a camera employing the "beater" movement. A small V-shaped double-hinged clasp Jenkins made, so that,

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by raising up the top and slipping a width of film in between the jaws and clamping them together, something after the fashion of a punch, he was able to accomplish the desired perforations. By chance he happened to hit on four marginal holes to a frame, one row on each side. This has become the world's standard by an interesting process.

Lumière in his apparatus used one round hole to each frame, and for a time the two methods were followed according to whether one accepted the French or the American standard. Holes of different shapes and sizes were tried till at one time there were on the market square holes, round holes, and triangles. Round holes were not satisfactory for the reason that a round peg engaging with them would have, theoretically, but one point of contact. Triangles tore easily. The exhibitors themselves were the ones who demanded standard construction, for the reason that when they bought one machine they were confined to showing film manufactured especially for that machine. Without a standard gauge their market was seriously curtailed. As a result the rectangular perforations as devised by Jenkins, engaging with a square face, were more and more employed. Lumière in France accepted the rounded rectangle to be followed by Robert Paul, till soon the standard was the one set by Jenkins. It is now used the world around, so that any piece of film may be projected in any machine, whether that machine be in Guinea or Guam.

The modern projecting-machine was there in principle. The light was at the left with the con-

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densing lens immediately in front, followed by the heat-eliminating cell, with the film passed in front of the frame aperture, and carried along by toothed sprocket wheels. The projector as used to-day is merely an improved machine.

With his vacation over, Jenkins returned to Washington—by train, it may be noted—somewhat at a loss as to what to do with his invention. Two years of intermittent experiment he had given to it, and now that he could project pictures with more or less success there seemed to be no call for it, for the reason that people would not believe what they saw. Seeing people moving was all right, but it was not as good as seeing real people. The invention seemed to be slipping back into a toy, just as the talking-machine had done.

In the Treasury Department Jenkins once more resumed his stenographic duties, to put his machine by till a chance acquaintance was formed with a man then unknown to him, who was from that time on to be a prominent figure in his cinematographic experiments. The man was Thomas Armat, son of the inventor of the coal-stove. With the coming of fall, Jenkins entered the Bliss School of Electricity, to be told by the principal that there was another student in his school who was also interested in animated photographs, as they were called. The principal accordingly brought the two young men together, marking the first meeting of C. Francis Jenkins and Thomas Armat. The latter was a student in the school studying electricity to perfect an automatic-feed arc-lamp. With the common topic of animated projection between them

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they fell into a discussion of the principles of projection, with the result that Jenkins confessed that he was kept from additional experiments by lack of finances. Armat, more fortunately situated financially than Jenkins, offered to co-operate with him in producing a machine that would more nearly approximate its possibilities than yet achieved. Jenkins eagerly entered into a partnership by which the two were to work up an improved projecting-machine.

An agreement, dated March 25, 1895, was entered into, with C. Francis Jenkins the party of the first part, which read:

WHEREAS, the party of the first part has letters patent of the U. S. for a certain invention of his known as the "Phantoscope," also application letters patent on certain new methods of photography, it is agreed, that—

First: For and in consideration of one dollar and the immediate construction and subsequent public exhibition and proper promotion by the party of the second part, of a stereopticon projection phantoscope, built in accordance with the principles set forth in the patent application first referred to above, the party of the first part agrees to assign and does hereby assign to the party of the second part an unincumbered one-half interest in the stereopticon for projecting phantoscope, as distinguished from the cabinet form of the instrument.

Second: The party of the first part agrees to allow the party of the second part to make films for use upon the phantoscope by the above mentioned photographic principles, but only five such cameras shall be constructed. And the party of the second part agrees to use every reasonable endeavor to preserve in secrecy the general principles upon which such cameras are constructed.

They immediately set to work on a projecting-machine of a different model. This they finished

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in April of the same year, but the machine as completed projected the film continuously. The machine, instead of being built along the lines demonstrated by Jenkins in Richmond, followed in the main the Edison Kinetoscope, with the exception that a revolving mirror was substituted for the Edison shutter. The light reflected from an arc-lamp passed through the film and fell on an arranged screen.

The picture was not a success. A dancing film of Carmencita was used, but by reason of the continuous projection and improper reflection it was so indistinct and so shadowy that their efforts seemed to have availed them nothing. Jenkins, more temperamental by nature than Armat, was for abandoning the experiment, but Armat insisted, and the two men, side by side, returned to their tables. The next two months they worked on the principle first used by Jenkins in Richmond, perfecting in June, 1895, a machine that would project pictures on the principle of intermittent movement. A joint application for letters patent was made on August 28th of the same year. The application was so granted and stands thus recorded in the United States Patent Office.

Three machines were built based on the principle of intermittent movement, and now that much time and a corresponding amount of money had been consumed in bringing these machines to their present state of perfection, the two men looked around to find some means of realizing on their investments. To sell to others and continue only in the manufacture of further machines did not

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seem advisable, as no showman was acquainted with the machine, nor had it been demonstrated that it had an appeal that would command the attention of crowds. In consultation they decided to try the machine out themselves to see with what interest it would be greeted.

Investigating, they found that the Cotton States Exposition was to be held at Atlanta. The needed concessions were secured and in August, 1895, they installed two machines of the new intermittent model and opened their doors to what they hoped would be an eager crowd. But there was no consuming desire on the part of the public to witness what was inside. Merely the opening of the doors was not enough. An announcer was placed outside who, after finishing his song and banjo selection, undertook to tell the crowd that inside for the modest sum of twenty-five cents one might see people moving who were miles away. The crowd smiled at his fumbling description, for the term motion pictures had not yet been coined, and passed on to the wonders of Hagenbeck's Wild Animal Circus. At the end of the week, when the concessionary collector came around, Jenkins and Armat held a hurried and imperative consultation. Scarcely a hundred persons had availed themselves of the opportunity to see the first admission picture show in the world.

A solution was reached when it was found that the hired announcer could not make clear in the minds of the passers-by what they would see, so it was decided to let the people come in for nothing, exhibit the pictures, and then from the platform

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explain that those who wished might deposit a quarter in the box on going out, but that if they had not got their money's worth they need not do this. An audience was invited in, the pictures shown, and nine out of ten passing out satisfactorily manifested their appreciation. The invited audiences were leaven to a doubting dough and soon others began to come. Business grew and it seemed that the two showmen were to make money, when one disastrous night fire broke out in the colored plantations which quickly spread to the motion-picture hall. In a few moments their concession was a total loss, with two projecting-machines lying among the embers.

Disheartened, the two adventurers came back to Washington and the cotton states knew them no more.

Again Jenkins took up his less exciting but more remunerative post with the Treasury Department, while Armat, financially freer, continued his experiments, but from this time on the inventive Damon and Pythias were no more. Their fires of mutual ardor had cooled and between them sprang up a coldness equaled only by the enthusiasm with which they had joined hands. Instead of working side by side in an experimental shop they were soon facing each other before the legal bench with a series of trials, counter trials, interferences, and appeals that has done little more than to confuse as to what was perfected by each in the days of the working partnership. Through court after court the differences of the two inventors were dragged.

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Discouraged by the Atlanta fiasco and believing that the invention had little interest to any outside deliberative and scientific assemblages, Jenkins came in for more immediate and appreciative glory by reading a paper before the Franklin Institute of the State of Pennsylvania for the promotion of mechanic arts on December 18, 1895, in which he showed in detail the working of his Phantoscope. Armat, on the other hand, having more faith in the invention, remodeled several parts and at about the same time that Jenkins was reading his paper before the Franklin Institute showed the remodeled machine to Raff & Gammon on the second floor of the Postal Telegraph Building, New York. The men who here viewed the remodeled Jenkins-Armat machine were the selling agents for the Edison Kinetoscope.

It was not until the next spring that Jenkins got up enough courage to show his machine again. This time he took it to the Board Walk at Atlantic City, where, directly across from him, was a row of Edison peep-hole machines where one had to peer through an aperture at the film itself, as previously explained, to see whatever might be of interest. Jenkins was showing the picture on a screen; Edison was still trying to interest the public with a peep-hole arrangement. Naturally the crowd went to the hall where it could sit down and enjoy the pictures with friends.

When the local exhibitors of the Edison machine complained of poor patronage, the agents, Raff & Gammon, who held state rights for the Edison projector, came to Atlantic City to find out what

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was the cause of the trouble. One glance and they were enlightened—the day of the peep-hole machine was over.

Stirred on to renewed interest in the Jenkins-Armat machine, Raff & Gammon demanded that Edison put out a machine that would throw a picture on the wall. Such a projector Edison had been working on and, although meeting with some success, had abandoned the experiment for seemingly more important matters. In January, 1896, Armat took to the firm of Raff & Gammon a model of the machine containing his alterations and entered into a contract with them to manufacture the machine in the Edison shops on a royalty basis, the machine to be known as the Edison Vitascope. The name Vitascope was given to it by Armat, following the popular trend by calling it a 'scope.

Armat was moved to enter into this agreement by which Edison was to get credit for perfecting the machine by a letter written Armat by Raff & Gammon under date of March 5, 1896, which well shows the marketing situation:

Kinetoscope and phonograph men and others have been watching and waiting for a year for the announcement of the perfection of the Edison machine which projects kinetoscope views upon a screen or canvas. No matter how good a machine should be invented by another, and no matter how satisfactory or superior the results of such a machine invented by another might be, yet we find the greatest majority of the parties who are interested and who desire to invest in such have been waiting for the Edison machine and would never be satisfied with anything else, but will hold off until they find what Edison can accomplish. We find that many of these parties have been approached in the last few months to invest in other similar machines,

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but they hesitate to do so, evidently believing that Edison would in due time perfect and put out a machine which would cast the others in the shade.

This being the case, you will readily reach the same conclusion that we have—that in order to secure the largest profit in the shortest time it is necessary that we attach Mr. Edison's name in some prominent capacity to this new machine. While Mr. Edison has no desire to pose as inventor of this machine, yet we think we can arrange with him for the use of his name and the name of his manufactory to such an extent as may be necessary to the best results. We should, of course, not misrepresent the facts to any inquirer, but we think we can use Mr. Edison's name in such a manner as to keep within the actual truth and yet get the benefit of his prestige. The machine might be made with a place upon which we could inscribe the words "Armat Design" or something of that kind, and you understand that after we have disposed of our territory and the business is fully established, and we have reaped the respective rewards, we will then make it our business to attach your name to the machine as inventor, and we are confident that you will eventually receive the credit which is due you for your invention. We regard this as simply a matter of business, and we trust that you will view it strictly in this light.

The joint application for patent had not yet been issued to Jenkins and Armat, but long ago they had parted financial company. Friction between them was growing constantly more marked, so to reach something as near approaching an amicable settlement as possible, Armat offered to buy Jenkins's interest in the joint application. After some negotiating the deal was finally consummated, Jenkins receiving twenty-five hundred dollars in cash for his interest. Small as this seems, this was the sum total that C. Francis Jenkins received for building up the foundation of the present motion-picture industry. Later comers whose only claim

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to genius was that of being better able to drive a bargain were to clear that much a week. .

For his activities in perfecting the phantoscope, the Franklin Institute voted to award Jenkins the



AWARDED C. FRANCIS JENKINS BY THE FRANKLIN INSTITUTE OF PENNSYLVANIA FOR HIS WORK IN DEVELOPING THE FIRST MOTION PICTURE

Elliott Cresson Medal in 1897, but while action of the Institute was pending Armat, hearing of the proposed honor, put in a protest, claiming that he was the inventor of the motion picture instead of his former partner, with the result that the Franklin Institute held up the award until an investigation

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could be made. The investigation was made and, acting on the report of the sub-committee, the medal of honor was bestowed in 1898 on Jenkins as the original discoverer of motion pictures in their present accepted form.

However, with the signing of the contract nullifying his interest in the joint application, C. Francis Jenkins passed out as an active pioneer in the motion-picture industry. The interest in him since is no longer historical. At the present time he is residing in Washington engaged in the manufacture of projecting-machines.

To C. Francis Jenkins we owe the motion picture. Muybridge was the father of motion pictures, but his career was ended before they were really an established fact. Muybridge was the father, but it was C. Francis Jenkins who brought up the child.

III

THE '49 DAYS

FROM a toy of a moment's passing fancy, the picture-projector had now advanced to where men were contending for its possession, for law-suits began to spring up as to patents and cross-patents. Audiences had viewed the new wonder in Richmond, Atlanta, and Atlantic City, but the nearest to motion that New York had seen was the Edison peep-hole machine.

Now that the Jenkins-Armat machine had come into the possession of the Edison representatives, preparations were made to give New York its first view of motion pictures. The month following the signing of the contract for the Jenkins projector, modest announcements sprang up over town that the new bill at a Twenty-third Street playhouse would show pictures that moved. The announcements were accepted smilingly by audiences whose curiosity had been piqued and disappointed too many times to take them seriously. Their anticipations were realized at Koster & Bial's on the evening of April 27, 1896, when motion pictures were projected on the screen for the first time in New York. The audience looked at them critically with but little or no applause, believing

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them to be some advance in shadowgraphy, then so popular. Theater managers, they held, were always trying to get something to trick the audience.

Pictures were now being projected on the screen in France by Lumière, in London by Paul, and were now shown in New York. But of the New York pictures Paul and Lumière knew nothing, so hurried their machines over to reap a rich profit. Lumière was the first to reach America, bringing with him his own projector, a machine superior to the Paul Theatrograph. True to the times, he selected as a name one that of itself would make the audience pay its respects, choosing Cinematograph as indicative of the worthiness of the invention.

June 29th, two months after the showing of the Edison Vitascope, the Lumière machine was set up at Keith's Union Square Theater, and showed to the audience as graphically as the flickering film would permit how Dover looked with a rough sea breaking over it. Further film showed the Lumière children picking flowers.

The audience filed out, as it had earlier at the Vitascope exhibition, without any particular enthusiasm, hesitating to proclaim that they had seen a new wonder of the world, for fear that it would be shown, after all, that it was merely some kind of trick. The only real enthusiasm aroused was among the showmen, always eager for novelties. No sooner were the pictures shown than a number of showmen opened negotiations for machines. One of these was a young man who was appearing in the different vaudeville halls with a quick-sketching act. It had occurred to him

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that this would be attractive as a novelty, and so, securing a projecting-machine and some film, began replacing his act with the film entertainment at halls and clubs where he was billed to appear. Almost at the same time a young magician decided that this new wonder would be as mystifying to his audiences as his disappearing rabbit was and promptly made arrangements for a machine and film. After these two young men had shown their film a few times they found that they would have to secure new subjects. But new films were difficult to get, so they began exchanging films, forming a loose partnership. Thus sprang up a friendship that resulted in a partnership out of which grew the present Vitagraph Company. The quick-sketching artist was J. Stuart Blackton, while the magician was Albert E. Smith. The name of the company, as may be seen, was an adaptation from the Vitascope.

Only action of the most pronounced type was photographed, the favorite subject being that of a railroad train dashing by at maximum speed, for it was believed that if there was not movement the interest of the audience would flag. Used for this purpose was the Empire State Express and the West Shore Railroad at Haverstraw. The pictures were taken by mounting a camera on a flat-car in front of an engine and the exposure made as the train rushed through a tunnel or out again into clear sunlight.

When it was found that it was not necessary to take a picture of a railroad train going at top speed to hold the attention of the audience, exposures

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of humbler action were made—of a circus procession or of a fire apparatus answering a call. That people on the film would be of any particular interest had not yet occurred to the manufacturers. Human beings, they reasoned, could be seen anywhere, but there were many who could not witness a fire company answering a call.

When pictures were first made of people it was considered necessary that the individuals photographed should be in violent motion. Otherwise, the manufacturers held, the audience would lose interest in them. The film most favored was one whose excitement was attendant upon a chase. A film that had a wide following showed an intoxicated man coming out of a saloon. Scarcely free of the doors he turned the bottle up and then started down the street, displaying much trouble in confining himself to the sidewalk. In ambling along, care-free, happy, and at peace with the world, he stumbled into a baby-carriage, upsetting the vehicle and depositing the child on the ground. The excited mother advanced upon him for immediate revenge, the man seeking to make good his escape by turning and running. The faster the avenging mother came, the more thoroughly the guilty man gave himself up to flight. Down the street the two started, the man holding on to his bottle. Anxious to see with what success he was trying to out-distance his pursuer, the man turned his back, thereby making matters worse, for in doing so he upset a bill-poster at the top of his ladder. To the flight the humble workman also gave himself. The avengers increased by the addition of a peanut-

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vender, a rich man in a top hat, a happy groom on the way to his wedding, and characters without number, until the manufacturers felt that the audi-



EXTRAS IN THE WAITING-ROOM OF A MOTION-PICTURE STUDIO

In the hope that they will be picked for a part by the casting director, young, old and intermediate fill the waiting-room and yard each morning on the chance that they will be called. From studio to studio they go, always in hope.

ence would have no emotion except that of commendation.

However exciting the taking of such pictures might be, there was just as much interest attendant upon the projection of them—at least to the operator, who took his life into his hands when he assumed the duties of projection. The machine often consisted of nothing more than a projection head screwed to a table, with a slit in the table for the film to slip through. Underneath the table

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was a sack to contain the film until the completion of the performance with time to rewind it for another projection.

One night the Dewey Theater on Fourteenth Street, New York, was showing the sensation of the day, called "The Life of a New York Fireman," which showed how a fire-fighter answered the call, carried the nozzle into the flames, and battled the element as part of his daily round. To enhance the realism of the fire scenes the operator was required to bend over, while turning the projector, and hold strips of colored gelatine in front of the lens for the purpose of coloring the scenes. While thus occupied, he felt a tap on his shoulder and turned to find a stranger beside him.

"I just came up from my seat," said the man, indicating the orchestra, "to tell you that something's wrong down there. That film has been running all over me."

The operator, still with his hand at the crank, bent over the balcony railing to discover that the film was silently running into the audience below. Instantly the operator abandoned his color scheme and began pulling up his film as fast as one hand would let him. When the end was reached, the operator was shaking as he realized how easily the ending of the film could have been quite a different story, with real firemen in the building where only shadows had been carrying on thrilling adventures.

Celluloid, cellulose and guncotton being the base of the film, it was highly inflammable. With an arc blazing a few inches from the film and with the film running into a bag or open container, many fires

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resulted. A match or cigarette falling among the squirming mass in the sack would put it instantly in flames. Stringent laws were passed, necessitating the segregation of the operator and machine from the audience. They were placed in a room behind the audience, projecting over the heads of the spectators on a screen. The lamp was unhoused and the film unprotected. Even in this day of advanced projecting-machines, where the film is now taken up on another reel instead of falling loose in a sack, it would be considered courting death and disaster to run a film without the arc being separated from the film by fireproof material. Having the operator in another room afforded protection for the audience, but it seemed to be taking a rather unfair advantage of the lone operator. When he went into the adjoining room there was always the likelihood that it would be his last public appearance.

It was from this projection that the present operator's booth arose. The room became smaller and smaller until it was only a booth, and to secure needed protection for the audience it was of either metal or abestos construction.

Laws passed in this early day of the industry are still in force, although the machines which they were meant to adequate are no longer in service. Now with the improved take-up and the housed lamps there is little or no danger of fire, but yet the laws must be lived up to, much inconvenience and harm as they work. It is only another example of how inadequately laws keep pace with progress, proving that it is a pretty safe assertion,

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one industry with another, to say that law is at least twenty-five years behind invention.

Only in New York and in some of the larger cities were moving pictures exhibited, and then only in vaudeville houses where they took the place of the accepted legerdemain act. The principal interest on part of the audience was to arrive at a conclusion as to how they were done. To make the mystery of their projection still deeper, bells and jingling apparatus were supplied with the projecting machine to further bewilder the audience.

How long only the larger cities would have known them can be merely guessed at if during the early summer of 1897 a young man by the name of William H. Swanson had not been sitting on the right-hand side of a train as he was passing through a small town in Indiana. From his window he could get a glimpse of a street carnival in progress, with its rows of tents, housing the fire-swallowers, the snake-eaters, and the man who was to be buried alive. An idea flashed into his mind. Why would not people in these small country towns be interested in seeing those queer pictures that seemed to move? But how could he show them? Plainly he must have some portable arrangement that he could transport from town to town with the closing of its gala week. The only feasible protection was a tent, but these queer motion pictures had to be shown in the dark. To Murray & Company in Chicago, the principal tent-makers in the United States, he went, and asked to see their line of black tents. Murray looked at him in surprise and informed him there was no such thing as a black tent.



THE BACK YARD OF A STUDIO, WHERE THE SCULPTURE AND CERAMICS ARE MADE
In the background may be seen a small Sphinx and the head of Ramses II used in the making of the production. "Cleopatra."

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Nor could there be. But the insistence and enthusiasm of the young man interested the veteran tent-maker, who finally agreed to make him a tent of the requisite size and paint it the desired color.

With the prospect of a fortune looming up before him, Swanson secured his concessionary privilege, and at Boonville, Indiana, only a short distance from where the first motion picture had been shown three years before, erected the first "black top." Outside the announcer was posted, who tried to tell the people of the wonders inside, but no one came, just as no one came to Jenkins and Armat in Atlanta. The doubting tillers of the soil looked the tent over, heard the barker's apotheosis—and passed on. They were too wise to be taken in by any such catchpenny. Finally, on Monday night, a free show was given, with the result that the next morning a few dimes were hesitatingly put on the counter. Immediately business began to prosper, with increasingly satisfactory results for Wednesday. Thursday morning the joyous proprietor telegraphed for more film and gave no heed to the increasing cloudiness in the sky. At two o'clock that afternoon, just as the crowd was beginning to avail itself of the opportunity so gratifying to the young showman, it began to rain. In half an hour the tent was a pure and unsullied white, while the gutter was running brim to brim with ink.

That was the last Boonville saw of the world's first "black top." To a tent-maker in Detroit Swanson went, and had made to order a tent that would be equal to all itinerant and climatic demands.

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Motion pictures were an established fact. Hardy pioneers were now making money from them, and as soon as money begins to result from a project it immediately commands wide and respectful attention. As long as money had to be expended in experimentation, and as long as the money was flowing out instead of in, the interest was local, but the moment it was established that this new vaudeville attraction was financially gratifying to its experimenters, immediately the interest was characteristically wide-spread. Not only to the projection of the pictures and to showing them in tents, halls, and vacant lots, and wherever crowds could be assembled, did the people devote themselves, but to the invention of other means and methods of projection did they give themselves, with the result that to the already formidable list of long names were added other new and equally inspiring ones. The names now came to include the Tachyscope, the Kinetograph, the Eilodoscope, the Animatoscope, the Chronopotographe, the Photocinegraphe, the Folioscope, the Viviscope, the Kinesigraph, the Bioscope, the Micromotoscope, and the Kalatechnoscope.

Westward across the United States the films began to work, meeting in each city the same slow acceptance. The audiences were interested but hesitant about giving their approval, for fear that, after all, the pictures might be accomplished by means of some trick which would make their judgment a laughing-stock.

In April, 1897, Thomas S. Tally, who was then operating a phonograph-store at 311 South Spring

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Street, Los Angeles, put up a sign over his door that brought crowds. The sign was the first framing of the now commonly accepted term to designate the illusion of continuous motion by reason of persistence of vision—moving pictures. The sign read:

COME INSIDE AND SEE FOR YOURSELF
MOVING PICTURES FROM LIFE

10c.

10c.

Hesitatingly the people came into the phonograph-store with the air of knowing that there was some catch about it all, but willing to spend the necessary admission fee just to prove to themselves what it was. The length of the store they were conducted, to the rear, where there was a small auditorium seating the record number of three hundred. In order not to darken the store to the discouragement of those who might wish to avail themselves of the opportunity to purchase a talking-machine, the pictures were projected through a long tunnel made of wooden hoops covered with canvas. This kept the light rays from diffusing with the illumination of the store, so that fairly presentable pictures were presented and yet left enough light for prospective purchasers, not interested in photographic trickery, to wander around and locate machines that particularly pleased them.

Three subjects were shown, the feature of the program being "The Black Diamond Express,"

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reaching the unparalleled length of three hundred feet. The audience left, their eyes already beginning to smart, little realizing that what they had just seen was in twenty years to rise to the place of the fifth industry in the United States and that Los Angeles was to be the center of that activity.

The rise of the motion picture to the fifth place is to be accounted for by the primitiveness of its appeal, for no other means of transmitted communication is so simple and direct as pictorial representation. The shortest path to the brain is through the eye, and it is to this directness that the success of the motion picture is due.

Ideas may be conveyed to the brain through the eye, the ear, or by means of feeling or smelling. The eye is the most common means of transportation, for its powers are employed every waking hour. A walk in the country is the means of bringing into the realm of consciousness a thousand sights in the way of trees, flowers, clouds, animals, insects, while the ear responds to only a few of the immediate sounds. The ear tells nothing of the properties of the insect underfoot or of the cloud overhead, while the sense of touch is relegated to the few objects that may be picked up on the way. The sense of smell on a walk is limited to a half-dozen odors with which the olfactory nerve comes in direct contact, while to the brain the eye brings a myriad passing impressions.

The eye brings to the brain the ideas of another either in chirographic or pictorial form. One may either see a picture or read a description. But a mental strain is attendant upon translating a pre-

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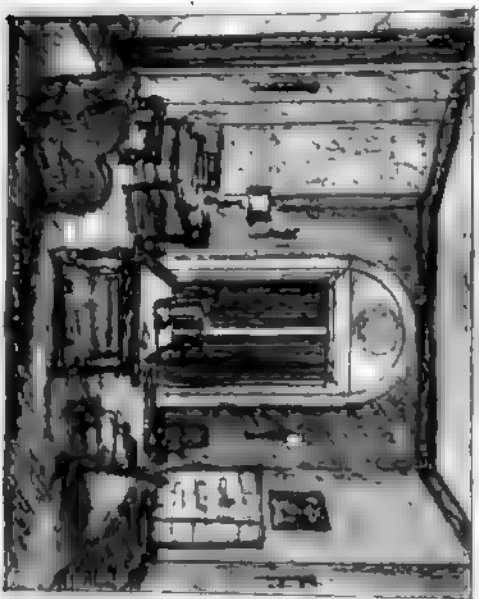
viously agreed-upon symbol into its visual representation. The juxtaposing of the letters *d*, *o*, and *g*, to a certain number of people trained in the English form of presentation, conveys the idea of a domesticated quadruped. To only a small part of the world does the monsyllabic grouping mean anything at all; even to those to whom it carries a significance it means only a small part of what a picture of such an animal would mean. The picture shows whether the animal is at rest or at play, whether large or small, whether kindly or antagonistic. To convey the ideas that the picture conveys at a glance would necessitate paragraphs of description.

Even before alphabets were agreed upon, rough drawings, scratched on stone, were conveying ideas. Priests took up pictorial writing and with the beginning of churches their messages were borne to the people by sculpture without and painting within. The churches in reality became great stone Bibles.

Pictures, always the books of the ignorant, continued to grow more intricate in form until their highest stage was reached in their present animation. Conveying their message by the most direct route and speaking with a universality of language unapproached by any other medium, their appeal is basic. Their language is the oldest, the most direct, and the most universal. It is for this reason that their field will continue to widen until the printed page, to the masses, is superseded by the animated picture.

The universality of the language of the motion

Ernie Stuart Room



BEFORE A SCENE CAN BE BUILT THE ARTIST MUST CONCEIVE JUST HOW IT WILL LOOK AND GIVE TO THE CARPENTER A SKETCH SHOWING HOW THE SET IS TO BE BUILT

Herewith is shown the preliminary drawing from the "Cinderella Man " To the right in the sketch it may be seen that the artist calls for a French chair—"not gilt."

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picture was impressed on the author as he sat in a theater in Cairo. The film, as it had come from the manufacturers, had the subtitles only in English. Cairo, a city of strange tongues, brought an audience only a small fraction of whom understood English, so in French the reading-matter was again reproduced, while on a screen a few feet away a translation in Arabic was thrown by means of lantern slides. At the same time, on the other side of the screen, the words appeared in similar stereopticon form in Greek. The pictures spoke to all, but the reading-matter had to be given to the audience in four different forms.

No sooner was it demonstrated in the early days that admission could be charged for showing these flickering films, than there was more demand than film. The Edison factory in Orange was turning out subjects as fast as it could do so, but was unable to supply the market. Many of the films were imported from Robert Paul in London and from George Melies in Paris. The scenes depicted were exteriors and covered a variety of subjects all easily attainable. Among the favorite films and the ones most widely distributed were "The Buffalo Horse-Market," "Feeding the Doves," and "Washing the Nigger Baby."

As if overnight what came to be known as "store shows" sprang up. One day the windows of a store that had just suffered a fire would be devoted to signs announcing the unusual bargains to be had in collars and cuffs, to be followed the next day by signs announcing that inside one might view motion pictures for the modest sum of five cents.

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Five cents was the universal price and permitted the audience to witness from two to four hundred feet of film, lasting from ten to twenty minutes. Members of the audience not yet satiated with pleasure could find ranged along the walls different apparatus for testing their fistic power and lung capacity for a similar modest sum.

The first store show to appear in New York was at 204 Broadway, but it did not prosper as the management had hoped, with the result that the doors were closed a few weeks later, leaving the people to look elsewhere to behold the wonders of "The Buffalo Horse-Market." The first successful operator of a store show in New York was William A. Brady, now known as a theatrical producer. The store wherein he showed to hourly audiences how doves looked at the hour of feeding was on Fourteenth Street, just west of Broadway, where even at this writing a motion-picture theater is yet located.

It was in August, 1898, that the author of this present volume beheld the glories of pictured motion for the first time. It was in the year of the Omaha Exposition and to it he had gone with his parents to revel in its wonders. But his parents were slow-moving objects who insisted on walking from one exhibit to another when so much more could be seen if one but ran from one point of interest to another. Vexed by the continuous delays and the frequent periods of rest, the writer was given permission to have a day unhampered by adult companionship, with ten cents to squander upon any attraction that he deemed worthy of the

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sum. For several blocks he carried the money without finding anything that seemed to offer satisfactory exchange, until he passed a candy-booth. For the rest of the day he had to confine his attentions to concessions where no admission was required. Before the day was very far advanced he had exhausted the booths where audiences were admitted and no questions asked, carrying the literature to a respectful distance before consigning it to a collection-can. Wishing more and more that he had accommodated his feet to the steps of his elders, where there was always a chance of getting another dime if a sufficient inducement suddenly loomed up, Heaven suddenly stood in front of him where a placard announced in no modest letters:

ADMISSION FREE

Immediately his attention was arrested. Hesitatingly he approached the winged entrance, for too many times he had been disappointed to find that the banner referred only to the first ten feet, where a financially interested individual in flowing coat stood on a platform and told of the wonders just on the other side of the ticket-man which might be viewed for a dime, the tenth part of a dollar. To his delight and amazement there was no gentleman inside in the accepted haberdashery telling of what was just behind the canvas protection. A man was just closing the door when he saw the author.

"Come on in," he called. "You're the last one."

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With that he seized the writer by the arm and shoved him inside with a despatch that boded evil for a free exit. With the closing of the doors the room was darkened. By the heavy breathing and the feel of the atmosphere he knew that the room housed many people. His confidence rose. United they surely would be able to make their way out, whatever the designs of the doorkeeper might be.

A hand fell upon his arm and led him to the front row. Into the seat he slipped, still uneasy as to his physical welfare, when out a shaft of light shot over his head. Turning to determine its course his worst fears were confirmed. The wall in front of him had suddenly opened and out of it a circus procession, with the slow, rhythmic movements of animals in motion, was proceeding. Each step brought the procession nearer. The leader was a great gray elephant, coming straight into the audience, swinging his trunk in anticipation. Jumping up, the author found himself in the aisle, headed for the door, when he felt a hand on his arm.

"Sit down—you're not going to be hurt!"

It was the voice of the usher, and before he knew what was happening the author felt himself pushed back into his seat.

The elephant continued to advance, but just before he reached the front row he disappeared safely off to one side. And then as the writer gazed he slowly began to realize that the creatures walking before him were not real flesh and blood. They were as harmless as the posters themselves. What he was seeing was not the creatures themselves moving, but only pictures.

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With the disappearance of the final clown the doors were thrown open, letting in a shaft of welcome light. A man standing at the door invited the audience to tell their friends and proffered literature that pointed out the advantages of trading by mail with Montgomery Ward & Company of Chicago.

This was the first sight of motion pictures for the author, and after all these years he never comes out of a theater or a projecting-room without a thrill at what he has seen.

As yet there had not been a single studio constructed for the making of motion pictures. The few pictures that had been made were made outdoors in the open—"exteriors," as they are called. Anything outdoors that moved rapidly was considered material for the motion-picture camera. Trains in transit were regarded as especially worthy of recording, and the more rapidly the train moved the more appealing it was thought to be.

No film embodying a story had been attempted. Faces were not looked upon in films with favor, for the reason that there was not enough motion to meet the demands of the director, and, more especially, it was argued, faces could be seen anywhere. Residents in small towns, it was believed, wouldn't be interested in seeing just faces; the things that would please them would be a New York fire company answering a call. They couldn't see that by merely looking out of the window!

When the list of rapidly moving objects was exhausted and the audiences no longer thrilled at the sight of doves being fed, the experimenters

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began taking pictures of merely people. The Edison Company, spurred on to renewed activity by the constant call for more film, and running short of outside subjects, experimented with one of the



"THE BLACK MARIA"—THE FIRST STUDIO IN THE WORLD EQUIPPED FOR THE TAKING OF MOTION PICTURES

It was built by Edison. The building swung around on a track to follow the course of the sun and the top opened to let in the sunlight needed for the taking of the pictures.

workmen at the factory suffering from the pangs of a person desirous of sneezing, but not able to carry out his intentions. Instantly the facial contortions of Fred Ott, now the personal body-guard of Mr. Edison, were received with demands for more.

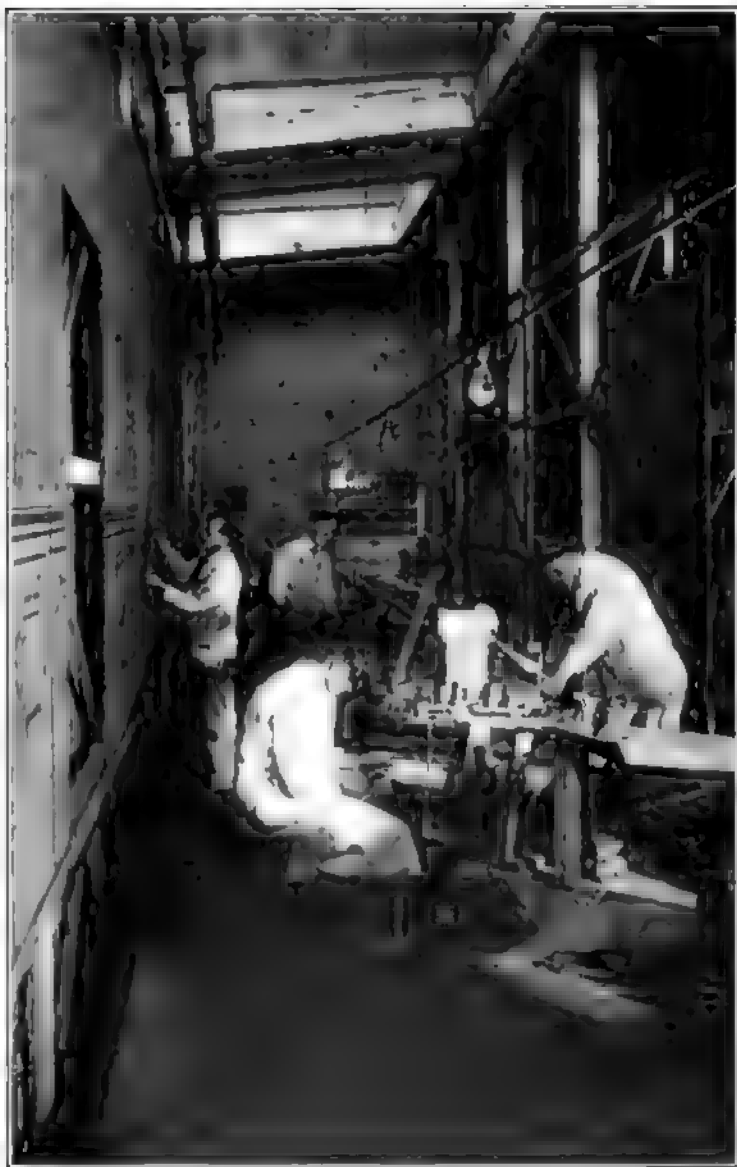
Then it was decided that there should be some apparent explanation for the sneeze, so a boy was posed shaking Cayenne pepper into the man's clothes. On discovery of the cause of his torture

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the unfortunate man brought needed repentance to the boy by bending him over his knee and administering the atonement in person. This the audience greeted with even more enthusiasm than it had the Black Diamond Express rounding Dead Man's Curve. There were now two characters appearing in the story. Slowly this was increased until half a dozen were appearing, but it was difficult to have all the necessary incidents happen to the six outdoors, so for the first time a studio was erected for the purpose of taking pictures. It was erected by the Edison Company at Orange, and by reason of the black paper that covered it it was given the name of "Black Maria."

The pictures had to be taken in the direct rays of the sun. To meet this demand the studio was constructed with a top that could be raised to admit the sun and lowered when more undesirable weather threatened. But to keep a room fitted up for a stage in the direct sunlight was the problem. The answer was reached by putting the studio on a pivot with the outer edge resting on a track, so that keeping progress with the sun was merely a matter of stopping the camera long enough to run out and get behind the handles.

Discouraged by the uncertainty with which they could get new film, the quick-sketching artist and the sleight-of-hand performer held a conference and decided to manufacture their own film. Just how they would do this was not very clear. About all they knew was that to take pictures sun was needed, and, probably inspired by this knowledge, they rented the roof of the building at 114 Nassau Street,



**SCENE-PAINTERS AND MINIATURE MODELERS AT WORK AFTER THE ARTIST
HAS GIVEN THEM THE SKETCH**

The workmen to the right are constructing a ship which will be used later in the studio tank for a marine scene

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and going as near the source of supply as they could, erected a studio. After the pattern of the Edison studio, it followed the sun in its daily course, giving up the rainy days to developing and to securing the stage so that there would not be so much danger of some one stepping off during the excitement attendant upon a stirring scene.

Motion pictures were still a novelty, to be viewed only by the curious, to speculate later as to how they were done. The audience always left more mystified than elated, certain that if they could get back to where the mirrors were they could show up the trickery in a few moments. In Kansas City lived a man, however, who saw a bigger vision, and so firmly did he believe that the powers of entertainment were not exhausted, as the common opinion was, that he set to work with an as yet untried idea in his mind. The man in question was George C. Hale, who had won fame as a fire-fighter, having taken his heroes on a tour of the world to exhibit their prowess. At Electric Park in 1905 the pleasure-seekers of Kansas City were surprised to find what seemed to be an observation car backed up a few feet from the Midway, with a large sign announcing

HALE'S TOURS AND SCENES OF THE WORLD

Entering the observation platform, the audience found themselves in a railroad train, with a row of seats down each side separated by a dividing aisle. The front end of the car had been re-

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moved and in its place a screen placed. Pictures taken from the pilot of a moving engine were projected on the curtain from the rear. By means of an elaborate system of brakes and hand rockers the car could be tilted at will. When the audience was seated a conductor came through in uniform, took up the tickets, and pulled the bell rope. Immediately the engine bell began to ring, the engine whistled, the exhaust of steam rattled, and the car began to move. Faster and faster it went, the bell ringing and the whistle proclaiming the crossings in long reverberating shrieks. Before the bewildered audience knew what was happening they found themselves in rugged Scotland, tunnels coming and going, flashing over trestles and past picturesque villages. Slowly the train came to a standstill, the breaks on the wheels jarring, and the conductor called out, "All off." Bewildered, the passengers came out into the open, confused at the sudden precipitation from the braes of Scotland to the glare of Electric Park.

Time after time the car was filled to its capacity of seventy-two passengers, those who had already been treated to Scotland returning to revel in the delights of the Rocky Mountains. Often as many as eighty audiences were taken on a stationary tour in the course of a day. From the first showing at Kansas City the Hale Tours spread rapidly to other cities going both East and West. William A. Brady, already mentioned, seeing the drawing power of this novelty feature, bought the right for ten Eastern states. From America the tours spread quickly to Hongkong, China, and to South

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Africa. When the first showmen arrived in London with the tours the London Mutoscope Parlor proprietors laughed when they found that only one admission price was to be charged.

"First class won't sit with third class," they said, and prepared their banners.

But American showmen thought they would, and mounted their cars. They were right—silk toppers stood patiently in line with Whitechapple to view the wonders of western Canada.

In this day of the Roller Coaster, the Figure 8, Loop the Loop, and Shoot the Chutes it was believed by even the most successful showmen that the feature of the attraction was the ride. Without the ride and the illusion of motion, they held, no audience could be attracted. To no one had it occurred that the people would be willing to pay money to witness the pictures alone. Something else must be used as the attraction and the pictures thrown in as an unsolved bit of sleight-of-hand.

THE CORRESPONDING PARTS PLAYED BY AMERICA AND EUROPE IN THE DEVELOPMENT OF MOTION PICTURES

AMERICA	EUROPE
1861, February 5th, Sellers patented stereoscopic attachment for showing photographs in motion.	
1872, Muybridge began experiments with collodion wet plates beside race-track in California.	
1881, Muybridge lectured in Europe on his discoveries.	
	1882, Marey in France constructs his "Photographic Gun."
1886, February 27th, Muybridge consults with Edison to solve some way of synchronizing	

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AMERICA

- Zoopraxoscope with the talking-machine.
- 1893, March 14th, Edison patented Kinetoscope for viewing moving film with pictures on it.
- 1893, Both Edison and Muybridge exhibit their machines at Chicago World's Fair—neither machine applying correct principle.
- 1893, December, Edison Kinetoscope shown for first time on Broadway.
- 1894, June 6th, Jenkins projects pictures from moving celluloid film on wall in jewelry-store in Richmond, Indiana.
- 1895, March 25th, Jenkins and Armat enter into partnership.
- 1895, August, Jenkins-Armat machine shown in Atlanta, Georgia, at Cotton States Exposition. First time admission charged to see motion pictures.
- 1895, December 18th, Jenkins reads paper on his achievements before Franklin Institute of Pennsylvania, for which he is later awarded Elliott Cresson medal.
- 1896, March 5th, Armat enters into agreement with Thomas A. Edison to manufacture and license the Jenkins-Armat machine under name of The Edison Vitascope—Armat Design.
- 1896, April 27th, Edison Vitascope shown at Koster & Bial's, Twenty-third Street, New York, marking first time for motion pictures to be projected on the screen in New York in form now known.

EUROPE

1896, March 25th, Robert Paul's "Theatrograph" shown in the Alhambra, London.

1896, June 29th, Lumière Cinematographe shown at Keith's Theater, Union Square—first public showing in America of Lumière machine.

HOW MOTION PICTURES ARE MADE

By August, 1896, New York had seen all three machines—Edison Vitascope, Paul Theatrograph and Lumière Cinématographe—and motion pictures were no longer a novelty to a metropolitan audience. Motion pictures were now looked on as a failure.

IV

WHEN EIGHT SOLDIERS WERE AN ARMY

THERE was an increasing call for motion pictures. In addition to the Hale Tours now being shown in every civilized country of the world, there was the growing need of the store show. With the repeated successes of the store shows and the added call for motion pictures for vaudeville houses, to be used as a last act so that the theater might be emptied quickly and peacefully, the demand for new subjects was constantly growing. Manufacturers were experiencing the pleasant embarrassment of having more orders than they could fill.

The difficulty in making pictures was not so much one of adequate studio, but a matter of getting actors. No professional wished to demean himself and humble his calling by posing in film plays. Positions to act in motion pictures were accepted only by those driven to such an extremity by lack of immediate funds, so that when an actor's face appeared in a film it was an advertisement up and down among the managerial offices that he had not sufficient ability to make a living at his calling. The actors that responded to the importunities of the film-makers agreed only on the provision that they would appear in such elaborate wig and

HOW MOTION PICTURES ARE MADE

toupee as to disguise them so effectively as not to endanger their professional standing.

Before a manager could go on with his play he must engage a sufficient number of actors to interpret it. The Vitagraph solved the problem by having William Shea of its staff go up and down the Rialto painting the glories of posing for the picture camera. Acquainted as he was with the performers, he had little trouble in singling out the players, but fear of lowering their professional standing sat heavily on them, with the result that they would promise to be on hand the following morning at the appointed hour, but usually failed to do so. The more certain they were to do this if they had made their financial needs known and had succeeded in borrowing a dollar as an advance on their forthcoming services.

With a full cast engaged, the recruiting agent would go home to find the next morning that only half of the number had shown up—the other half having found work in the mean time or remembered the lowering of their craft's dignity. With only half of the members present necessary to the carrying forward of the scene meant the doubling of actors. In one instance, driven by the exigencies of the situation, William Shea played fifteen parts in a one-reel projection, and in "At Valley Forge" he was compelled to die twice in a hundred feet.

While putting on "Julius Cæsar," and while the actors were waiting on an empty lot in Flatbush for the filming of the army scene, it was suddenly discovered that there were only seven pairs of brown tights to accommodate one hundred pairs of legs.

WHEN EIGHT SOLDIERS WERE AN ARMY

To send the property man back to a costumer's would mean that the picture could not be finished on that day and the consequent return of the actors on another day with another day's salary going to them, even if all of them reported on the follow-



THE DRYING-ROOM, WHERE THE FILM IS PUT ON DRUMS AND REVOLVED SO THAT ALL WATER SPOTS MAY BE THROWN OFF AND NO DISTORTION APPEAR ON THE COMPLETED FILM

ing morning—a hope that gave no promise of being borne out in practice. Studying the situation and hoping to advance his usefulness in the eyes of the proprietors, Shea was seized with an idea that in the enthusiasm of the moment seemed to fall little short of genius.

"We can run over to the nearest store, get some brown paint, and save the picture," Shea enthused.

His suggestion was promptly acted upon, the

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soldiers being able to appear in a few minutes with legs meeting all requirements as to color. The scene was filmed, Shea modestly taking credit for saving the picture. But when the citizen army retired to the studio to wash up and garb themselves in their street clothes, there came a protest from the crowd that would have delighted the heart of a stage manager eager for realism. Shea's appearance among the erstwhile soldiers served only to increase the complaint of the crowd as they washed and scraped at the unyielding brown. Put on without grease paint and wholly unintended for the purpose, the brown had a tenacity that promised to live up to the advertising matter on the cans that announced in years its period of longevity.

To-day, when the actors have everything in the way of comfort and convenience, even to the extent of a motor-car especially constructed with a make-up table and dressing-curtains to be used on location, the crudities of the early days seem years ago instead of merely months. In filming "Romeo and Juliet" the construction for the balcony scene was entirely forgotten until a few minutes before it was to be photographed. Without it the story could not be produced. Equal to the emergency, the actor laid aside his cloak, hurried to a carpenter shop, and, coming back with a hammer and saw, proceeded to build his own balcony. When the last nail was driven he verified his grease paint in Juliet's hand-mirror and, donning his robe, signaled to the camera man that he was ready to proceed with the passions of the immortal lover.

Dressing-rooms were a luxury yet undreamed of,

WHEN EIGHT SOLDIERS WERE AN ARMY

so that when it came time for the cast to make a change of costume embarrassment was relieved by the men stepping outside the building to some sheltering corner, leaving the studio to the ladies to make ready for the forthcoming scene while the men threw out a protective living line, the actor inside availing himself of the shelter to garb himself in the needed costume. His toilet completed, he stepped in line while another member of the cast metamorphosed quickly from Lord High Chamberlain to a merry villager.

The number of actors required for what even then was considered an elaborate scene was nominal. An appearance of richness of cast was obtained by requiring each actor to double one or more times. Even in the making of "Washington at Valley Forge" by the Kalem Company, the American army as commanded by that intrepid general numbered only eight. By dodging back a sufficient number of times the audience felt satisfied that the Father of His Country had a sufficient support to repel the invaders.

Actors were engaged by the day, and paid off in the evening. Many altercations arose as to what was considered a day's work. An interpreter of the emotions that surge in the human heart would be engaged to convey these emotions to the film and would report at the studio on the following morning as he had promised. But something would be the matter with the camera, an important piece of property would be missing, with a delay that lasted until the light was too low for photography. Disagreements arose as to whether the actor had

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worked' and whether he should be reimbursed, arguments resulting that ended in fistic encounters, with the result that it was agreed that it should be called a day's work whenever the actor had put on his make-up. He might sit around all day, finally to go home with the coming of the evening without having appeared in a single foot of film, but, according to the agreement, he was to be remunerated with the same degree of certainty as if he had played Hamlet. The putting on of a make-up was considered the equivalent of signing a contract and is still so considered among the extras. Five dollars a day was the universal pay, and was paid at the close of each day, so that the director was always uncertain as to whether enough of his cast would show up the following morning to finish the picture. Although five dollars a day was the accepted emolument, three dollars extra was paid for any additional hazardous feat that the actor might be called on to perform during the day. If he was required to fall from a horse or leap from a burning building three dollars extra was to be in his envelope that evening. As a result, when the boat upset there was such a spirited scrambling to get in the water that instead of depicting the horror of the catastrophe the cast often registered satisfaction that was unmistakable.

A step toward getting better actors was achieved in 1896, when after persuasion Joseph Jefferson agreed to appear before a Biograph camera. This he did, taking, as it might be supposed, the title rôle in "Rip Van Winkle." In the scene where he delivered his famous toast the camera was brought

WHEN EIGHT SOLDIERS WERE AN ARMY within a few feet of him in order to portray the full expression on his face, thus accomplishing a "close-up" for the first time.

The acting as portrayed by the camera was merely a symposium of athletic activities. From the moment of their entrance to their exit they were in a constant state of physical activity—running, tumbling, and falling. Especially the latter, for it was found that the audience delighted in seeing some one tumble, and as a result no scene, however short, was considered adequate unless one or more of the characters suffered an accident. No attempt was made to show mental processes or fleeting emotions. It was considered disastrous to stand still and try to portray what was going on in the mind by facial expression. The portraying must be done by bodily contortion, preferably anger as displayed in a wild and ardent pursuit. With the advancement of the art, the best actor is now held to be the one who can convey his meaning to the audience within the fewest movements. Instead of having to start in hasty pursuit of some one who has gained his ill favor, carrying a club to substantiate his claims for revenge, the actor now tries to convey the same feeling by a straightening of the lines of his lips and a contraction of his face muscles.

The actor has been helped to dignify his profession by advancement in stage illumination. In the early days, when lights were poor, actions had to be more or less heroic in order to register. Now with manifold arcs, Cooper-Hewitts, and radium lights, the slightest action is conveyed to the film. In fact, the face of the actor in the enlarged views

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known as "close-ups" shows to the audience in much more detail than it does even to those in the most advantageous seats in the legitimate theater. While the art of close-up has advanced, it has also worked a disadvantage to some actors, for it not only brings out the slightest meaning that the actor wishes to convey, but also the smallest facial imperfections. A face that from the footlights seems to meet all requirements of beauty, when enlarged to cover ten feet of screen is found to consist seemingly of nothing but irregularities. The nose reveals an unexpected hump, a mole shows on the cheek that up to that time had successfully defied all audiences, and teeth that from the orchestra looked so brilliant and gleaming show unmistakable signs of dental ingenuity. Such vivid and faithful portrayals on the part of the camera long kept many stage favorites from surrendering themselves to the cruelties of the camera, for fear that the moles and crow's-feet would be brought to light which were heretofore unsuspected by admirers.

Many of the film favorites of the day have what in the profession are termed "camera-proof faces." The best known of these is Mary Pickford, who, little difference how near the focusing-lens, shows up without a blemish or a mar.

As the number of producing companies began to increase rivalry resulted and everywhere was there "duping." One film company would make a picture and promptly a rival would make a duplicate from a print and sell it as its own product. This could not be stopped, as there was no adequate copyright law covering it. To offset this the legal

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departments advised putting a trade-mark somewhere in the picture, as duplicating a trade-mark was a serious offense. As a result, one witnessing the stirring scene in Juliet's tomb would experience the shock of seeing obtruding from some corner the words, "Thanhouser," "Bioscope," or "Edison."

However, the producing companies had more to worry about than mere anachronisms. Arriving at his studio in New Rochelle one morning, Edwin Thanhouser found the floor of the studio covered with snow, a result of a delay in erecting the glass top. As he stood gazing at it the idea of putting on a story with the scenes laid among the snows of Siberia came to him, and, calling his director, a plot was hastily drafted up and immediately work was begun. But another element was to be reckoned with, so that by mid-afternoon practically all trace of Siberia had vanished into the gutters. Several hundred feet of film had been exposed, and, unwilling to sacrifice this, the producer and director got together over the plot with the result that when the story was shown on the screen the new scenes appeared under the subtitle, "Panama, a Warmer Clime."

As soon as it was demonstrated that motion pictures was a new industry and that money was to be made in it, rivalry sprang up which, as in the case of all new inventions, resulted in litigation and cross litigation. The Motion Pictures Patents Company, actuated by the Edison interests, entered suit for infringement of patents and began licensing machines to other manufacturers, who wished to engage in the business, at two dollars a week. Rival

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manufacturers felt, and with some provocation, that the Edison claims were unjust and continued their activities, with the result that the Motion Pictures Patents Company took the law into their own hands and began wrecking rivals. When a producer went out to work he went with the air of a hunted man, stealthily watching all avenues of approach. Just as he would get his camera set up and his hero and heroine were in a solemn embrace, strong-arm men would descend upon them, break up the camera, and expose the film. Many ruses were resorted to to facilitate the taking of scenes. One group of actors would go out with a dummy machine and empty camera, and would pretend to be in the throes of an exciting scene, upon which the malcontents would descend to find that the real scene was being enacted several blocks away. A camera would be set up on the sidewalk to record a scene, and when the rivals would bear down upon it a delivery wagon would calmly drive off unsuspected. Inside it, masked from sight, would be the real camera.

With each succeeding year the demand for motion pictures became stronger. They were no longer looked upon as a means of dismissing a vaudeville audience or as a means of securing patronage for a beer-hall at a park resort, where, by drawing back the curtain to allow a passing glimpse, the curious might be inveigled inside and made to refresh themselves with a glass of beer. Instead, intellectual people were watching them weekly with unashamed interest. With the growing demand for them the film manufacturers ventured into strange

WHEN EIGHT SOLDIERS WERE AN ARMY and unknown seas. The average subject was two or three hundred feet in length when the Edison Company announced that it had completed a film eight hundred feet long. It was "The Birth of a Nation" of its day; even the most experienced exhibitors having their doubts as to whether an audience would sit through eight hundred feet of film, unrelieved by vaudeville offerings.

It was called "The Great Train Robbery" and established a new pace for lavishness. No expense was spared in making the film, the makers proudly proclaiming that the sum of four hundred dollars had been spent on it. The exhibitors took the announcement with a grain of salt, little dreaming that thirteen years later a million-dollar picture, "The Daughter of the Gods," would be announced to a more passive audience.

The picture opened into immediate action, without wealth of explanatory title or elaborate introductory bow, and proceeded to get more exciting with each succeeding scene. A lone telegraph operator was sitting at his desk in a wayside station when four masked men, gaining silent entrance, covered him. Without explanatory title the picture proceeded to unfold and ran its length without reading-matter—an accomplishment that directors are now striving to attain. After many intervening years the directors are coming back to the technique of their first production.

The telegraph operator was overcome and made to send a despatch ordering the train to stop. Climbing over the tender, the robbers overcame the engineer and proceeded to the immediate pur-

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pose in hand. Soon a posse was organized which brought swift justice on the heads of the evil-doers in the most approved retributive style. While the robbers were being chased by the representatives of law and order, one of the robbers was shot and fell from his horse headlong into the gutter, dying in front of the camera with the characteristic immobility of camera killings, with never a twitch or a contortion as he passed to his punishment, thus marking the first screen as well as the first saddle appearance of G. M. Anderson, the much worshiped Broncho Billy.

It is interesting to note that Anderson reported to the director in Summit that Sunday morning to rebel bitterly when he found that he would have to ride a horse, agreeing only on the condition that the gentlest animal in Crone's Livery Stable should be selected. A spavined selection that met the demands of the rider was made and the fall accomplished, the hesitating Thespian little realizing that a career that was to make him a world favorite as well as a producer was just beginning. Later he became the A of Essanay, the S representing George K. Spoor.

Horseback-riding furnished the requisite action, coupled with a picturesqueness that brought it into instant popularity. When an ethical doubt arose as to the advisability of showing the intimate details of the sacking of a train, the exploit was turned to that of chasing Indians, with the result that American films were soon the most popular in the world. To all corners of the globe the American Indian went. His picturesqueness appealed



"THE GREAT TRAIN ROBBERY" —THE FIRST LONG FILM EVER MADE

In this film "Broncho Billy" made his initial appearance. From beginning to end in this play there was no subtitle or explanatory reading-matter of any kind

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to all nationalities. The author of the present volume recalls sitting in a motion-picture theater in Bangkok and listening to the audience call out between change of reels for an American film advertised for later appearance on the program. Cowboy they could not pronounce, coming as near it as they could in an excited call for "Co'boy! Co'boy!"

While the passengers were being held up in making "The Great Train Robbery," one of the number whirled and started to run. The robber turned his gun on him, the passenger dying in front of the camera. The shooting brought out the Summit authorities, who, indignant at the desecrating of the Sabbath calm, arrested the director and the cast and remanded them to the calaboose for the night.

The picture when completed found an eager public, with the result that the film cleared for the Edison Company a profit of a little more than ninety thousand dollars.

The cost of the production was only four hundred dollars as pointed out—made possible by the fact that there was only one studio set. The others were exteriors, where the train and the horses furnished the background. The one studio set is shown herewith where the lone operator suddenly looks up to find that he has callers. On the wall over the head of the crouching robber may be seen the station clock which adequately supplied all the demands of the audience, although painted on the wall!

Through the open window to the right the audi-

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ence saw the train draw up, stop, and go on again, although the picture was made in a studio a good many miles from a train. Thus the American audience was treated for the first time to a double exposure. How double and multiple exposures are accomplished will be taken up at length in the chapter devoted to trick photography.

Following the demand for Wild West films wherein heroic cowboys and treacherous redskins had the center of interest, manufacturers began to attempt plays of a more formal nature. The picturesque chaps of the cowboys began to be replaced by the evening clothes of the banker's son. With the success of metropolitan attire no play was looked on in quite the light of a success if somewhere in it there was not a dress suit.

It was at this time that a motion-picture producer, still with the accent of the fatherland about him, met in a popular bar an actor of the legitimate stage who had risen to some prominence in his profession. In fact, the actor in question had recently been the leading man for no lesser light than Maude Adams.

After a few mutual felicitations the actor remarked to the effect that he had been seriously considering entering the movies.

"Is t'at so?" asked the complacent motion-picture manager with more interest.

"Yes," returned the actor. "I feel that it would at least be a new experience."

The motion-picture manager looked him over narrowly and then said, "Vell, come up and see me. Maybe I'll give you a job." And then he turned

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and asked, with an immediate directness that betokened fortune for the actor if he could but meet the requirements of the profession, "Have you got a dress suit?"

So it was. All that was considered necessary by more than one manager for entrance into the realms of motion-picture acting was the ownership of evening clothes.

V

HOW THE SCENES ARE TAKEN

THE constantly increasing financial returns justified larger expenditures, with the result that instead of having all the scenes taken outdoors, interiors were made in the carpentry shop, representing boudoirs, dance-halls, opium-parlors, and what not, consisting for the greater part of canvas painted and stretched over frames. With the camera at a calculated distance and with the characters moving frantically enough to keep the attention from wandering, the audience gave little heed to the sets which lent atmosphere to the action, with the result that often a king's palace was merely a stretch of canvas with a pine throne. In fact, it might be noted, if the Lord Chamberlain turned too quickly, striking the palace wall with his distaff, the whole regal institution rocked.

However, with the financial emoluments that each succeeding picture brought, more money was spent in properly constructing the king's palace. Instead of painting the curtains on the wall, tapestries were bought and hung, with walls replacing the painted backdrops.

Audiences no longer satisfied with painted walls demanded real rooms, with the result that "deep"

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sets replaced the painted representations. From the back, or up-stage, the character or characters advanced into the picture, thus showing that the set had depth, the illusion being so perfect that many of the audience believed that they were watching a person in a real room. As a matter of fact the room consisted of two walls, with the recording camera set up at the proper distance.

A variety of materials are used in constructing the walls of a set. Canvas painted and decorated for the purpose was long used, but with the advance in the art, materials less likely to show the flimsy character of the hall and grand stairway were used. A composition board came into use, which not only lent itself to paint more easily, but did not shake with such informative freedom when a door was closed too rapidly. Designs may be painted on it more readily, permitting of a quick change from the poor man's garret to the rich man's billiard-room. Lined and diagrammed to suit, it changes quickly from a studio floor to that of a palace wall. Tapestries may be hung on it and pins inserted to hold the wall draperies in place.

With the dismantling of old homes, rich in mahogany trim, picture companies are notified and bids sent in. For forty dollars all the wall, fireplace, and stairway mahogany of a home may often be bought and moved to the studio or the company's store-rooms, to be used as a whole or in part as sets may require.

Period pieces not easily obtainable at warehouses or auction rooms are made from papier-maché. A Hindu god may never have been nearer India

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than Brooklyn, but in its papier-maché form it is as convincing as the Oriental original. The fireplace and the robbers' cave that stand out so realistically with their smoke-grimed stones all proclaim the skill of the papier-maché department.



REFLECTING LIGHT BY MEANS OF AN ALUMINUM SCREEN

In this way the faces of the characters are made to stand out in detail.

To understand more thoroughly the steps in the actual filming of a picture, we will follow the arrival of a manuscript, its acceptance, its production, and the distribution of the finished film.

In the early days little attention was paid to the story. All that was considered necessary was to secure a number of actors and have them do something; little difference what, so long as they were moving and having clashes of will. A boy stealing

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a string of wienerwurst, with his consequent pursuit by the butcher, was all that was needed to hold the attention of the audience. As audiences grew more discriminating they demanded the same lights and shadows, purposes and cross purposes, as exhibited on the stage. Formerly the director had started out with an idea, such as a boy going to church with a bag of pepper, and constructed the story as he went along, stopping when he had completed the accepted number of feet. The stories were not written; they were conceived as the director worked. With the demand for plays the directors found it necessary to buy stories from the outside; soon scenario editors were employed who passed on the acceptability of the stories, rejecting the unsuitable ones and bringing the more promising ones to the attention of the directors.

More and more attention began to be paid to securing strong stories, with rising dramatic value, illustrating character change and clash of will. Skilled writers were sought and soon adaptations from famous novels began to appear. The first film version of a novel was put on with some hesitation, the fear being that people having read it would have no further interest in it. The reception exceeded expectations, the story meeting with more interest than if merely spun for the occasion. Other producers, always with a watchful eye on the other, began to bring out film versions of well-known novels, with the result that in a short time practically every famous novel was either in the course of preparation or litigation. As a result of this demand for famous stories, the owners turned



A MOTION-PICTURE CITY IS THE GATHERING-PLACE OF THE ODDS AND ENDS OF THE WORLD
The more picturesque they are the better chance they have of getting a place. Douglas Fairbanks is shown picking his Mexicans and cowboys for the making of "Headin' South."

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to the classics—it might be said of many, for the first time. Their position as guiding financial factors was not attained by their literary profundity, but for their knowledge of credit and discount. Many of them, still speaking with an immigrant accent, suddenly found themselves called upon to decide as to the dramatic and artistic merits of literary creations that until this time they had never suspected the existence of. It was at this time that the owner of one of the film companies was approached by an enthusiastic scenario-writer who was all aflutter with the managerial triumph that had just been his.

“I’ve got something big,” exclaimed the scenario-writer. “I’ve got the film rights to *Pudd’nhead Wilson*.”

The film magnate took the announcement calmly. “Ve,” he said, with an expressive shrug, “don’t want to knock the President.”

The story as it arrives in manuscript form at the studio is told in as few words as possible. On its acceptance, a working script is made from the story. The working script lists where all the action takes place. The story of the Prodigal Son, arriving at a studio, might be in the form that we know it, but production could not be started while it was in such form. From it would have to be made the working scenario, which would list the different scenes. The departure of the son, leaving his unyielding father and anguished mother behind, would be one scene; the return of the son in rags would constitute another scene. In a single-reel story—which means one thousand feet of film,

HOW THE SCENES ARE TAKEN

taking some fifteen minutes to show—there are something like thirty scenes.

Going over the play, the scenario editor makes out a list of characters and gives it to the director who has charge of the immediate production, that he may be making his selections. He must determine on the star, the leading man, and the support. The star may be engaged on another picture, or the leading man may be wavering in his allegiance, due to a more attractive offer from a competing company. With the principals determined on, the lesser characters may be chosen more slowly.

That the director may keep them in mind, the scenario editor gives him a list of the parts for the forthcoming story. It may read:

Rose Geyer, factory girl.

J. M. Beagle, owner of the canning-factory. Spider.

Lover.

Two toughs.

Character woman.

Butler.

Baby.

Chauffeur.

Factory superintendent.

Twenty-four girls.

Skill is needed in working out the script by the scenario editor, whose value to his employer is determined by his ability to put the story in as few scenes as possible, for the building of each set necessitates just that much additional expenditure. His ability is gauged by the novelty of his scenes, their verisimilitude, and their effectiveness. One scenario editor that the author calls to mind so cast his story that when the handsome lieutenant

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lover marched away to war he told his sweetheart good-by in front of the army without stopping to think that each soldier was costing the company five dollars a day. Later the script was turned over to a more experienced man who had the handsome young lieutenant tell the girl good-by in her parlor, thus eliminating an army's expense.

The scenes are divided into two classes—exteriors and interiors. By exteriors is meant a natural outdoor setting, where the trees, the river, or the ocean is employed as background or property. An interior is made in the carpentry shop and in the taking is illuminated by artificial light. To the natural properties of an exterior may be added other properties by the studio manager. A chasm, with its precipitous sides, may suggest the locale for a feat of courage. Across the opening a bridge is strung and over it the hero gallops his panting steed while the camera preserves his valor for the edification of future audiences. To the natural setting the property man has brought his kit.

In the hands of the scenario editor the story has been simplified into exteriors and interiors, so that when he hands the list to the director it may be divided as follows:

INTERIORS

Canning-factory—machines pasting on labels.
Doctor's office.
Hospital room.
Manager's office.
Childs' restaurant—flapjacks.
Directors' room.
Elevator shaft—practical.
Library—deep.
Church—with pulpit.

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This indicates the sets that will have to be constructed in the workshop. The other list indicates the sites that will have to be chosen to depict the outdoor scenes:

EXTERIORS

Bole of tree, circular seat.
Country town railroad station.
Chicken-yard, rooster crowing.
Ocean liner, life-boats.
Mail-box on street corner.
Brick-yard.
Rain-storm.
Palm Beach.
Manhole.
Canning-factory yard—crowd.
Whistle—steam blowing.

With the sets determined upon, preparation for the taking of the picture is begun. The order in which the scenes will be taken is decided upon, for never are the scenes taken in the order shown on the screen. The first scene, as revealed on the screen in the theater, may be the last one actually taken. The least expensive and most economical order is determined upon. If the story calls for scenes in the mountains all scenes that deal with this part of the story are taken while on that location, wherever may be their place in the final story. If one or more scenes call for snow, then all the snow pictures are taken at the same time, while the ground is covered. If one or more of the scenes call for water, then all the ocean scenes are taken at the same time, whatever their order, to save expense of rehiring the yacht.

Scenes wherein crowds are used are all taken as

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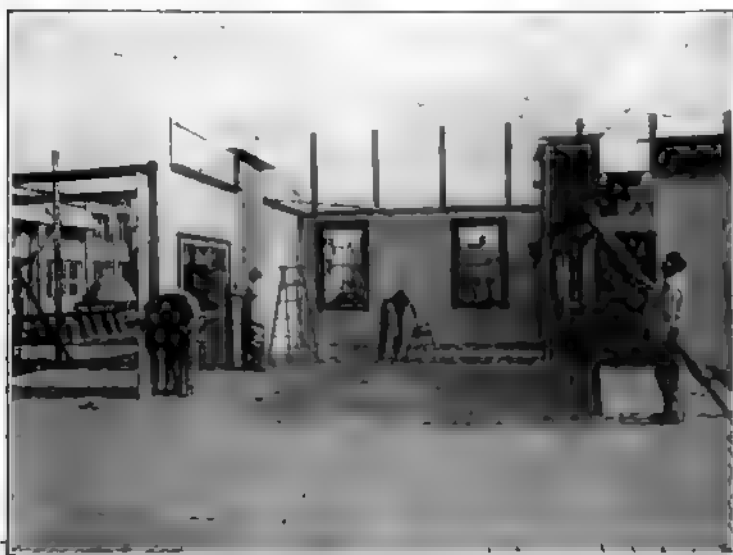
nearly the same time as possible, the members paid off, and the story continued with the regular cast. It is a particularly ambitious picture that demands a crowd for more than two days, for the reason that all preparation is made for the expensive scene, the principals are drilled in advance, so that when the members gather a few rehearsals suffice and the picture is photographed.

Crowds are secured in two ways. A crowd may be secured from an agency which makes a business of supplying actors by giving such an agency two days' notice. The agency will not only supply the characters to appear in the front rows, but will also supply make-up and means of conveyance. It participates in the financial returns by getting a commission on the wages of each person booked.

If the picture company so wishes, it may secure its own crowd by placing a small advertisement in the papers, instructing those who respond to be at a certain vacant lot by a certain hour. From there they are conveyed to the scene of action by the company omnibuses. Lunch is furnished and the usual rate of pay is a dollar a day. The response to such an advertisement is surprising, for the reason that in a city such as Los Angeles there are many people there for the climate—the cafeteria devotees—who are only too willing to participate in a novel experience, considering a dollar ample financial remuneration for the thrills they have had. In fact, crowds of a thousand people have been assembled in Los Angeles where the only inducement was free lunch and transportation, the members accepting as satisfactory settlement the privilege



THE FIRST STEP IN BUILDING AN OPEN STAGE SET



THE SECOND STEP. THE WALLS OF THE SET ARE NOW UNDER COURSE OF CONSTRUCTION

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of seeing themselves on the film and pointing out to excited friends just which spear they are carrying.

With the scene locations determined upon, a list of the interior sets is handed the chief carpenter, who promptly starts building the necessary woodwork. The list tells him in what order they will be wanted, with the date on which the first one will be needed impressed on his mind. He is held responsible for the finishing of the scene by the time specified. In every production there is always one scene known as the "big set," which overshadows all the others in size and outlay. Strangely enough, this may not occupy as much time in the showing of the completed film as some humbler scene, nor may its dramatic value be as great as that of some simpler set, but from the point of view of the carpentry shop and that of the cast it is the "big set." The filming of this is put last to give the carpenters time to complete it.

From a bare wooden platform the carpenters, under the direction of their chief, may start to work. In the picture herewith reproduced the carpenters may be seen in the first stages of their work, nailing down a hardwood floor where only a soft pine one had been before. To the immediate left of the platform may still be seen the remnants of a moonshiner's cabin and to the far left of the picture all that is left of the once proud Roman Forum. On the platform to the right may be seen the canvas protection thrown around a former set to ward off the eyes of the curious. Such a shelter is used only by some temperamental star who feels that she cannot lose herself in her rôle



THE MINIATURE CARDBOARD MODEL, ON A TABLE, FROM WHICH THE LARGE
SETS ARE TO BE MADE,

The scene is from "Thais," and the street is one in Alexandria, Egypt.



THE BUILDINGS UNDER COURSE OF CONSTRUCTION FROM THE MODELS
JUST SHOWN

At the far end is the temple wherein Thais worships.

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while the object of curious eyes. In such a case the director tries to give her the necessary privacy by throwing a canvas fence around her that she may imagine herself miles from the nearest spectator.

The second picture shows the work after a day's progress. The carpenters are at work putting up the composition walls, supported, as may be seen on the right, by planks serving as stage braces. The walls go up only a few feet over the heads of the workmen, but when shown on the screen are complete in the minds of the audience.

When the chief carpenter has turned in his report that the set is ready, a list enumerating the properties to be used in that particular scene is given to the property man, who is held responsible for their presence at the time needed. For the first interior, showing the canning-factory in operation where the heroine is to be injured by the labeling-machine, the list may read:

Six labeling-machines.

Chairs.

Gross of tomato-cans—have cans filled with sand.

Printed wrappers.

Power shafts.

Conveyer belt.

Sign on wall—"Girls Caught Carrying Cans From Room Will Be Discharged."

Water-bucket with old-fashioned dipper.

Preparation is hurried for the filming of the first scene. The principals are engaged. A star may be hired for the making of that particular picture and may sever her connection with the company

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on its completion, or a lead, under a long-time contract, may be cast for the part.

Much depends on successful casting, for bigger than the scenery, greater than the story, is the personality of the star who is to give life to the



THE TEMPLE AND BUILDINGS ARE NEARING COMPLETION

In the immediate foreground is the well, and on top of the bazaar to the left may be seen the artificial trees.

idea. From all the players under contract to the producing company the leads are selected. The plan of each director having his own little cast and working with them in picture after picture has been found inadvisable, so the generally accepted plan now is to consider the several hundred actors employed by a producer as one large stock company from which any one may be picked for any rôle. This, as may be seen, gives a much larger choice in the casting of a play. Instead of having to pick his hero and heroine from his own company

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of possibly fifteen players, he has the several hundred in the employ of the parent company to choose from.

On file is kept a photograph of not only each salaried actor, but also each one with whose work the casting director is familiar. Over this set of photographs the director, the casting director, and the managing director go, the photos serving not only to call to mind the players, but also showing what types they represent. A blond girl is needed to take the part of a stenographer. From the list the type is selected and then by referring to the working list it may be told at a glance for what director she is working and when her present picture will be completed. If she is free in time to go into the picture, and if she meets the requirements of the three who hold her immediate destiny in their hands, she is cast for the part. If, however, her present engagement overlaps that of the starting of the new picture, another actress is selected for the part.

When the parts are cast the list is tacked on the call-board—an event eagerly awaited by the players who surround the board, some finding good news and others turning away with brave faces.

Thus the principals are engaged. The minor parts are filled by the casting or by the assistant director, who goes into the "yard" of a morning, where there always is to be found an anxious crowd awaiting his decisions. A more picturesque scene is not to be found around a studio than this variegated crowd awaiting the appearance of the casting director. Slips of girls, patently in their best,

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stand alongside gray-haired actors whose seamed and dissipated faces explain their present eagerness to get parts as extras; workmen, their hands still stiff from the shovel, and mothers with babies



NOW A TYPE ACTOR. ONCE AN IRON-MOLDER

A typical example of the persons who find ready work around a studio.

on their knees. The workman with his hard years deep on him may be the first one called. Face and figure count little in the selection of extras, for types rather than experienced actors are wanted.

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Just such a character was chosen one morning by the casting director for the Vitagraph. An iron-worker in Pittsburgh, he had come to New York in hope of further employment, but his years were against him, with the result that he was forced to public lodging-houses. Here he first heard of the demand for help at the studios, and after some hesitation joined the crowd that may be found any morning in a studio yard. Seamed and lined of face, his ragged and unkempt hair falling to his shoulders, he attracted the attention of the casting director and was given a small part. With some little histrionic ability he succeeded in conveying the emotions the director wished, with the result that he was engaged for another picture. Soon he was making more money than he ever had in Pittsburgh and began to want to have his hair cut, to be shaved, and to appear in clothes more suitable to a person of his new calling, but he was told that if he had his hair cut or bought new clothes he would lose his position.

It was near just such a motley band of applicants at a studio in Los Angeles that the writer was standing, when there was a commotion, with people running and struggling. Hurrying over, it was found that a girl had fainted and was being carried to the company hospital. An examination was made by a medical attendant, who found that the girl had fainted from hunger. Bit by bit her story came out. Eager to become a motion-picture actress, she had applied morning after morning without success, her money finally giving out, with the result that she had given up riding to

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the studio, using her car fare to get food. When food was no longer to be had she still came, but without success. This morning the strain had been too great, with the result that she had fainted and fallen.

Her story came to the ears of the director, who became interested in her and in his next production gave her a chance. She was equal to it and it must be related that there is no longer any danger of the lady fainting from hunger. If she runs any risk now it is from gout.

With the discovery among the players that they have been cast for a forthcoming production, their immediate concern is to know the length of the story, their eagerness naturally being for a multiple-reel effort. Their eagerness to appear in a long story is accounted for by the fact that a five-reel production insures them that much longer engagement and also more attention from the press.

Their eagerness appeased as to the length and probable time of production of the new play, they seek out the director to find how many costumes and what part or parts they are to play. Their eagerness to know what their part is and how many changes of costume there will be is accounted for by the fact that they have to furnish their own gowns. For smaller parts and for costume plays the dresses come from the costume-room. However, a star would scarcely be satisfied with a gown that had already made its screen appearance on the back of some other interpreter. She is eager to know how many changes will be hers, anxious to appear in as many gowns as possible

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that will set her off to advantage, and yet thinking all the while of the costumer who hangs heavy over her head.

The day for the taking of the first scene is posted, with a consequent flurry to make sure that everything is ready. All parts are to be dressed at eight-thirty and anxiously the cast waits in the yard for the critical eye of the director, which instantly fastens on anachronisms. At a glance he discovers a glove unknown to that period and sends the careless actor to the costume-room to replace it. The make-up of one character is too heavy, another too light, and so back they are sent either to improve themselves or to be replaced by others.

Members of stock companies are required to make themselves up; they are supposed to know that cerise photographs white and to know how much grease paint it takes to offset the glare of the radium lights. Extras and supernumeraries are made up by a professional make-up man, as illustrated in the accompanying photograph, wherein a comedy part is being made up. On his head is a wig and over his shoulders a wipe-cloth to keep his clothes from the contaminating touch of the make-up box. On the wall over the head of the make-up man hangs a picture of Abraham Lincoln, used as a guide by the make-up man when called on to make up a Lincoln part.

With this assembling of a tentative cast, newcomers are reported out for screen tests, for all faces do not lend themselves to a camera. A girl taking a pretty part may meet all the demands of the eye, but as interpreted by the camera she

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belongs in a part where character more than beauty is the aim. Another face that attracts little atten-



MAKING UP A COMEDY PART

Unskilled actors do not know how to make themselves up, so a specialty man is kept for making them up. Over the actor's shoulders is the wipe-cloth for keeping the grease paint off his clothes.

tion by way of accepted standards appears to such added advantage when thrown on the screen that the owner is cast as a beauty. Faces that are

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broad and regular in feature best lend themselves to screen adaptation.

With the cast assembled, the company goes to the first scene, which, as explained, may be in the middle of the story. An interior is chosen so that if at the last moment some of the characters reveal a stiffness or incapability before the camera others may be substituted before going too far into the story. Change of a character in the middle of a story is a serious thing, for it means that all the preceding scenes will have to be retaken. The cast must be jealously guarded, for they are the most valuable property controlled by the manufacturer. Without them the sets amount to nothing. Before beginning an expensive production the star is insured, for if, after working on the film for several weeks, she should be injured, it would mean not only the delay in completing the film, but, if the injury was lasting, the rebuilding and the retaking of the preceding sets. For this reason the taking of the dangerous scenes is put off to the last. Then if the star or any of the leading characters are injured they may recuperate without keeping the film from going into the hands of the exhibitors.

If an exterior is chosen for the first scenes it has been selected in advance by the "location man" and the director. To the former falls the duty of familiarizing himself with all spots in his territory that may have the least photographic appeal. This he accomplishes by riding around, often on a motorcycle, with a camera slung over his shoulder, making photographs of possible locations. Picturesque spots form only a small part of the loca-

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tions he must bring back; he has to have on his finger-tips ravines, brick-yards, gnarled trees, railroad stations and crossings, oil-wells, palm-trees, alkali, and dead men's curves. The photographs are filed away alphabetically, so that when the director is ready to cast his exteriors he has but to turn through the photographs instead of having to go out himself and spend hours looking up suitable locations. If he wishes a gnarled tree for the final love scene where the hero clasps his new-found treasure to his fast-beating heart in a slow fade-out, he has but to turn through the G's.

Exteriors are reached by automobile, the cast having their choice of going in cars furnished by the company or in their own. The latter are usually chosen by the stars and others in the cast whose histrionic ability has been capitalized to such an extent as to permit this selection.

Make-up is accomplished before leaving the studio, the actors going out in costume. The make-up is done in their dressing-rooms for the reason that they are accustomed to the light in the dressing-rooms and know the touches needed to secure desired effects. In the early days make-up was done under gaslights, but when it was found that when one made up under gaslight and came out and was photographed under arc or radium lights an entirely different effect was secured. All parts are made up, however small, for faces photographed in their natural color, when revealed on the screen take on a pallor disconcerting to an audience. Even in crowds those in the forefront and those whose faces register are required to make up. The differ-

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ence between natural flesh tints and make-up is revealed in a picture where the character's hands show. It is often a shock to see a beautiful lady under the glow of an evening lamp sit down to a piano, revealing hands that look as if they had not the personal attention due them. The difference between make-up and nature is readily noticeable in a scene wherein a baby figures. The rest of the faces in the scene are white and clear, while the baby's face is dark and murky.

Babies and pets are considered welcome relief to a play. Many stories have been ready for filming when it was discovered that no child or animal was called for, with the result that room was made for them merely for the appeal. The vogue runs from horses to kittens, from puppies to pet deer. Without knowing it the audience has been enthused over many scenes wherein the story was dragging, by suddenly having revealed to them the star sharing her cream-puff with a frolicsome puppy.

The company passing from the dressing-rooms to the set in which they are to work is only one company of many. Actors are coming and going, all in make-up, presenting a startling appearance when seen out of their surroundings, passing jests, gossiping or sharing sorrows with some particularly responsive soul. Coming and going among them are the scene-painters, stage-hands, electricians, property men, and the varied individuals necessary to the conduct of a large studio.

The author calls to mind his first experience at a studio. He was not only surprised at the variety in the sets, but more so in the verisimilitude of the

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characters thereabouts. On a Monday morning he reported at the studio with which he was to be identified, and was walking down the yard for his first view of the open-air studio, when his attention was attracted by a young lady in front of



WORKING IN A GLASS-TOP STUDIO. THEDA BARA SEATED

As may be seen, the room consists of but two walls.

him with her face partly turned, revealing herself to be smoking a cigar. Astonished at this freedom which he hoped he would not find characteristic of the West, he hurried up to get closer, that he might study the Western type that would so far forget all conventionality as to smoke a cigar in public, when he was more perturbed than ever to see the young lady slap a man so familiarly on the back as to cause him to lose his cap. When the

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young man answered her challenge by retaliating with an equally vigorous slap, the young lady defended herself so capably as to find it necessary to remove the cigar from her mouth. Peering into her face, at the conclusion of the encounter with the young man, the author was relieved to find that the lady so calmly puffing the cigar was a young man, doubling for a leading lady in a bit of hazardous fire jumping.

With the setting up of the camera and its focusing, are marked out the camera lines inside which all action must take place. Outside, either the scenery shows or the characters are out of focus. What to the audience seems to be a luxurious room consists, as a matter of fact, of two walls without a covering. Naturally the camera sees only the corner made by the intersecting walls and revealing just enough over the characters' heads to make a ceiling unnecessary. In fact, a ceiling would shut off the light. As may be seen in the picture reproduced herewith of Theda Bara, the light is either natural or from lamps especially constructed for the purpose. Sunlight is used when possible to save electricity, a cloudy day necessitating recourse to the artificial illumination. In the picture, Theda Bara may be seen seated, while immediately in front of her is the director, with the assistant director behind, scenario in hand. A reference to the manuscript outlines the action that takes place in this particular scene. To the left may be seen the scene-painters already at work on a new set.

Many and exasperating are the delays before the actual photographing of the scene begins. Just

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as the picture is ready to be taken it is found that the leading lady, illuminating the character of Mary Queen of the Scots, is wearing a pair of shoes from a mail-order house, with the consequent delay in rehabilitating her wearing-apparel. Close atten-



THE WASTE FILM LEFT AFTER THE CUTTING DOWN OF A FAIRBANKS PRODUCTION

Twenty thousand feet was exposed, but only five thousand feet was shown.

tion has been paid to the light, for if the picture is not good, photographically, the best acting will not save it. In addition to the numerous arc and radium lights, screens are used to bring out each detail. These stretches of white are held so as to reflect the light advantageously. Even in outdoor scenes they are used, as in the illustration, which insures the bringing out of the faces sharply.

Time after time each scene is rehearsed, even

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more care being used than in the legitimate drama, for in the older drama the scenes can be modified and improved as the play progresses, but in photoplay the scene once photographed is beyond recall. From different angles the characters enter, and in varying tempos the scene is played, the director building up the scene until satisfied—or at least until convinced that he can do no better—when he calls, "Camera!"

Directly on finishing the scene it is filmed again, the second exposure being called a "retake"—rephotographed in case it is found in developing that the camera has buckled or that static marks were on the negative.

In large sets where much money has been expended and whose filming means their destruction, more than one camera is used, as naturally in such a case there would be no retake. If the scene in particular is that of a collision between two trains, and at the unusual expense the engines have been procured and the scene staged, the failure on the part of the camera to record what is before it means not only the rebuilding of the scene, but also delay in getting the film on the market.

In battle scenes, where a thousand or more characters may be used, as many as twenty cameras may be used in the filming of a battle charge—the destruction of the walls of Babylon, the sacking of Rome, or whatever the scene may be. The cameras are posted at advantageous positions, some on the ground level and some at an elevation, in order to get varying and unusual views. A method originated by D. W. Griffith, and since employed

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by others, is the photographing of a spectacle from a captive balloon. This gives a bird's-eye view and when inserted in the scene at the proper place gives an impressive effect.

From a lofty platform the director watches the scene going on beneath him, with all the equip-



FROM THE MAKING OF O. HENRY'S STORY, "THE LOVE PHILTRE"

The walls of the set are made out of composition board. By looking carefully in the corner it may be seen how high the adjoining walls extend.

ments of a field general at his service. When he wishes one wing of the hired army to advance he takes up his telephone, has central connect him with his assistant in charge of that particular sector, and orders a charge. Of the many thousands of feet of film made of such a scene, only a small part can be used. The best is selected and the other discarded, the expense of the film being nothing in comparison to the staging of the set. As may

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be imagined, many thousands of feet of film are taken in photographing a spectacle that are never seen by the public. Twenty reels of negative were exposed in making "Intolerance," which was cut down to seven before being shown to the public.

The costliness of a particular scene in a spectacle is in no way indicated by the time it occupies on the screen. A scene that has cost twenty-five thousand dollars to stage may last only twenty seconds on the screen, while a simple love scene over a garden gate may last two minutes. It must be said that directors, after displaying an elaborate set, craftily working to keep the production expense as low as possible, do not altogether forget the footage possibilities of an exterior love scene.

VI

IN A DAY'S WORK

AS seen on the screen, posing for a motion-picture camera seems easy, but such is not borne out in practice, much as it has been to the surprise of those appearing for the first time before the camera. As seen on the screen, the lover simply takes the girl into his arms and tells her that she is his world, while the dimmer comes down and the orchestra strikes up a stirring march, but in actuality that scene has little of the romance in it, the chief factors being those of worry and work. Time after time the scene has been rehearsed, until the actors are beginning to shrink at the sight of each other and then filmed with the glare from the high-powered lights blinding their eyes. Nor is the set the romantic place that the audience, seeing only the part allotted it, believes it to be. The beautiful boudoir that the audience sees is bounded by two stretches of canvas, and surrounded by stage-hands whose last consideration is silence. The stage-hand is sweeping up, the carpenter is pounding, the electrician working with the sputtering light, while a group of loafing actors exchange stories of past conquests.

With the lights blinding her eyes, the actress has

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to imagine herself in an entirely foreign scene, and when the director snaps his fingers she must have tears. Even though the radium lights dry up the tears before they can begin to glisten, she has to have them at the proper moment, or all the preceding film goes for naught. The bringing of the tears at the proper moment has perplexed many an actress, with a unique solving by some of them. More than one, knowing when the tears are to be needed, has taken advantage of the preceding scene to get out her onion, with such startling realistic results as to enthuse the coldest audience. Others, with no opportunity to bring such an irritant into close proximity to the lachrymal gland, place their dependence on glycerine, the large glistening drops of which satisfy the audience that the girl has suffered beyond endurance.

The completion of the film means almost a collapse for some of the principals who have had to stand the glare of the lights. Douglas Fairbanks, eyes strained by the glare, gives himself several days' vacation before starting another production.

With the commotion incident to the filming of a scene, many directors try to bring their cast to the mood of the scene by having music played during the process of filming, as shown in the illustration on page 133, where a talking-machine plays music appropriate to a Russian setting. Other directors, themselves more temperamental, demand the more realistic product of a complete orchestra.

In sets where a crowd is being used the confusion is all the more marked. In elaborate sets in which a hundred or more persons are working a wheeled



**A GREAT DEAL GOES ON IN A STUDIO THAT THE AUDIENCE KNOWS
NOTHING ABOUT**

However surrounded by turmoil, the actor has to place himself in a mood far removed from what his eyes see. In the background may be seen the set that is being photographed.



THE AUDIENCE KNOWS NOTHING OF THE FOREGOING

It sees only this. George Beban is shown in a setting that as far as the audience goes is a room far removed from distraction.

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device is used to bring the camera to the desired spot. It is mounted on a low-hanging frame, guided by a regulation wheel-grip, and upheld by inflated tires. Air-tires are used so that the device may be withdrawn when occasion demands and while the picture is being taken, without resulting vibration showing on the screen.

This particular scene is known as the ball-room set. That the background is merely painted canvas relieved by artificial palms is never realized by audiences on seeing the film.

Before the director is the problem of how to get illumination on the faces of the actors. Even with the dozens of arc-lights and radium-tubes hanging over a set, the problem is not altogether solved. Studio illumination is a profession in itself. With the pose held in a certain way all the faces may have the necessary light effect but one, and then the problem is how to bring the needed one out. Often it can be done by placing a canvas screen at just the right angle; again it may mean adding another lamp, with a consequent delay.

Normally the action is at shoulder height, and as a result cameras are built to meet such requirements; but in the upper illustration reproduced on page 135 the action is on the floor. The lights are all hanging in the flies above, which naturally would throw the Oriental's face in shadow. In the picture he is dropping a dagger through a hole in the floor on some unsuspecting person beneath, so that if the audience does not see clearly what is going on the point of the situation is lost. His face is to reflect with what success he accomplishes

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his unworthy object. Naturally, if this expression does not carry the scene has no point. Everything depends on the character's face mirroring the slightest emotion. Better to show this the camera



OFTEN TO MAKE THE CAST FEEL THE MOOD OF THE SCENE MUSIC IS USED

In this Russian scene Russian music is being played.

box was placed on an abbreviated tripod which kept the camera from looking down on the back of the Oriental's head. Then the expedient of bringing the light into his face was tried by stretching a piece of canvas on the floor, with success, as is shown in the illustration on page 135. It may be of interest in passing to call attention to Hughie Mack, the comedian, in the background.

A different problem is confronted when the scene is an exterior, far from the accessories of the stage. The scenario may call for a woodland scene, with

HOW MOTION PICTURES ARE MADE

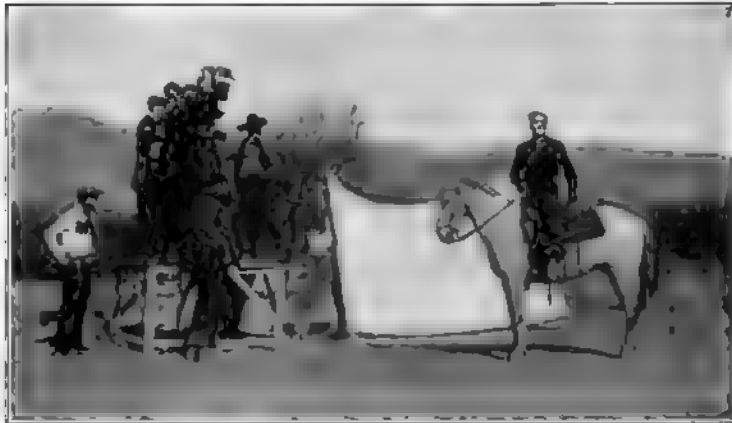
the lover and the maid plighting their troth under a weeping willow. Weeping willows have always been the despair of the camera man, who cannot understand why the scenario-writer does not cast his scene under a poplar, but the light question is now solved by the power-wagon, so constructed with its own dynamo and batteries that it can set up its arc and illuminate the darkest exterior love scene that the script calls for.

With the scenes taken in the most financially advantageous succession, naturally it is wondered how they are ever brought together in the final assembling in the proper order. Especially is the interest natural when it is considered that the film is put together by a person who knows nothing of the plot. Before him on the tables are the scenes as brought to him from the printing-room, varying in length from five to a hundred feet. To his lot falls the duty of getting them in their proper order—this when he does not know even what the story is about. The matter is simplified for him by the director, who gives him what might be called his film cues. Immediately following each scene a record-board numerically descriptive of that scene is taken, as may be seen in the upper illustration of Pauline Frederick on page 137. The assistant camera man is holding up the tally-board which shows the number of the scene as it appears in the story. Ford is the name of the director, with the figures 145 indicating the number of the story as shown on the company's books, which is of interest only to exchange men in ordering by wire. "Amber" indicates that the scene is to be tinted amber,



**ILLUSTRATING THE USE OF LOW TRIPOD WHEN THE ACTION IS NEAR
THE FLOOR**

The Oriental is shown dropping a dagger through a hole. The stretch of canvas is used to reflect light up in his face.



**FOR THE PHOTOGRAPHING OF SO SIMPLE A SCENE AS AN EXTERIOR OFTEN
HALF A DOZEN MEN ARE NEEDED**

Douglas Fairbanks is shown on horseback.

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while the letters "AMC" are the initials of the camera man. The director stands with script in hand, rehearsing the scene. In the pocket of the assistant may be seen a railroad folder, which he holds up when the camera is first set up on the scene, to help the photographer get his focus. When the letters are bright and clear the photographer knows that he has the proper focus and so announces to the director, who then takes the scene in charge.

The hand focusing-board is particularly adapted for exterior work. For studio scenes, however, a more elaborate board is often used, as shown herewith. The board may be seen to the left, on the wheel platform, with the name of the director in the middle. Beneath is shown that it is the second reel, by means of the figures on the revolving disk, while to the right are the words "Close Up," indicating that the camera is in such juxtaposition as to reproduce a bust picture. The figures at the top indicate that seventy-two scenes have gone before. In the picture Mr. Baker is the gentleman in the foreground instructing with much physical vehemence the comedians in the background in their rôles.

One of the commonest mistakes made by the histrionically ambitious appearing for the first time before a motion-picture camera is that of working too rapidly. With only what they have seen on the screen at the local theater to guide them, they imagine that they must work as rapidly as the characters there portrayed. Those appearing for work for the first time are surprised to find that



**A FEW FEET OF FILM IS EXPOSED OF THE FOCUSING-BOARD SO THAT
A RECORD MAY BE KEPT OF THE DIFFERENT SCENES**

Pauline Frederick in "Sleeping Fires."



ILLUSTRATING ANOTHER TYPE OF FOCUSING-BOARD

The board shows that it is the seventy-third scene of the second reel. Through the window may be seen a small dummy housetop.

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the action is interpreted by the actors as slowly as that of the older stage. The speed is accounted for by the fact that the projection is hurried up. A person may walk across the room at a normal rate of speed, but when shown on the screen the person is going much faster than he would under the actual circumstances. This is accounted for historically rather than physically. As explained in the first chapters of this volume, it was deemed necessary that all action should be rapid, which accounted for the number of chases to be found in the early films. It was thought that the audience would lose interest unless the characters were moving at an increased rate of speed. This tradition still holds, so that, even though the actors pose their parts at a normal rate of speed, they are projected on the screen at an increased rate of speed, in the belief that faster action will be more likely to hold the attention of the audience.

There is some basis for this psychologically, for the reason that when an audience gives up all its attention to one character or one set of characters it has a right to demand that the character it is watching shall do something of interest. The eye always takes cognizance of what is moving. Ten chorus girls are standing in line, with no motion on part of any one of them. The audience inspects them impartially, but if one of them should put a pair of binoculars to her eyes, immediately every eye would be fastened on her at the expense of her companions. So the theory is commonly held among directors that the more motion there is the more interest on the part of the audience.

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Films may be shown on the screen at any rate of speed wished, so slowly, in fact, that the characters move with the mechanical jerkiness of dancing dolls, or they may be shown at such a rate of speed as to blur the figures. However, the projec-



LIVING OVER AGAIN THE DAYS OF BRET HARTE. "M'LISS."

Two cameras are used, so that if anything goes wrong with one the other will probably have the picture. The photographer to the left has in his arms the still camera. All eyes are directed toward Mary Pickford.

tion is practically uniform in all theaters and is made so by motor-driven projecting-machines. This assures the projection of the picture at something near the rate of speed desired by the manufacturers, who take this into consideration in posing the picture. A picture that takes twenty seconds in the actual filming may be projected on the

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screen in sixteen seconds, accounting for, in brief, the accelerated rate of speed.

In this way is explained why the wind seems to be blowing in so many picture plays. However, this is a bit more complicated subject than one at first supposes. There are several factors which must be considered. Ninety per cent. of the motion pictures made in America are taken in California, on account of the actinic value of the sunlight. California sunlight is especially clear for photography, and in addition it is certain. In New York, even on the days it doesn't rain, the sun is up one moment and down the next, with the result that the picture is spotted.

The brilliancy of the California sun accounts for the fact that American pictures are superior photographically to European pictures. Negatives sent from England, France, and Italy are often rejected on this side on account of fogginess. In addition, more elaborate sets are used in the production of the American films, assuring spectacles beyond the means of foreign competitors.

In California the sun is constant and the pictures may be taken any day of the year, from much earlier in the morning until far later in the afternoon, with the exception of the week or ten days in the early spring when California gives herself over exclusively to precipitation. Then interiors are made.

Pictures are taken in the sunlight whenever possible, not only on account of the saving in electricity. A battery of arcs and Cooper-Hewitts accelerate the meter to an extent that makes the

IN A DAY'S WORK

financial manager begin studying time-tables. In addition, it also saves building a set, an item that assumes ominous proportions by the end of the year. Now with ninety per cent. of American pictures taken in California, and with most of them exteriors and the ever-present ocean breeze blowing, there is, as a result, an unusual amount of movement on part of the curtains and draperies. In fact, some directors, wishing to give additional stimuli to the brain, set up, when there is no breeze, an aeroplane propeller to bring about the necessary animation. As a result a flag or drapery that may be moving quite slowly when the picture was taken appears in the projection to be violently agitated.

A similar optical illusion accounts for the familiar phenomenon where the wheels of an automobile seem to be going backward. The car is advancing, but the wheels, when the car is moving at a certain rate of speed, seem to be going in the opposite direction. This may be simplified in explanation by imagining a wheel with just one spoke. If the spoke is standing at the point taken by the hands of a clock in pointing to twelve, and if the spoke makes the complete circuit and gets back to exactly where it started in the time that the camera requires to expose one frame—one sixteenth part of a second—then the observer would think that the spoke had not moved. The spoke would of course have made the complete revolution and returned to its starting-point, but it would have done so so rapidly that the observer, hindered by the camera, could not detect that it had moved. However, if the spoke

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had moved at a faster rate of speed—made the complete movement and advanced one inch—then the observer would think that the spoke had traveled only the inch. He would not be aware of the fact that the spoke had made the complete revolution and had gone an inch over; he would think that the inch marked its complete movement. Now if the spoke did not move quite so rapidly and lacked an inch of getting back to its original starting-point, then the observer, not knowing that it had made the complete circuit with the exception of the inch, would think that the spoke had gone backward. The illusion to him then would be that the wheel with its spoke had gone backward. This in simple is the explanation of the phenomenon, the illusion being in no way cleared up by an increase in the number of spokes. The whole phenomenon depends on the rate of speed with which the wheel is revolving.

The question that always faces an actor, whatever the scene he is in, whether he is working fast or slow, is, in the words of their profession, "Am I getting it over?" With an audience in front, the answer is immediate. When a film is the medium the answer is weeks in coming, and by that time the actor is probably cast in an entirely different character. The scene that gives him immediate concern may be that of comedy where he plays the part of a butcher boy, and by the time he has found if the points he wishes to make carry to the audience he is probably cast as a doddering old man. The area of interest cannot be as broad in a motion picture as on the legitimate stage. In the instance

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of battle scenes and spectacles the interest is chiefly that of setting; in comparison the characters are of minor importance. The camera sees only a small part in the intimate scenes that the eye does. If the director wishes it to see only the hand grasping the dagger, then the camera is so placed to



THE ENGINE AND AUTOMOBILE HAVE BEEN SO TIMED THAT THEY WILL COME TOGETHER AT THE CROSSING

The picture is taken slowly so that when it is projected both train and automobile seem to be moving more rapidly than they really are. In the car is a dummy.

show only that detail of the scene. On the legitimate stage the director could not keep the eye from seeing all that was on the stage. What it does see the camera brings out more plainly than can be seen by those even most favorably situated in the audience. Even the jewels on the hand grasping the dagger can be seen, and the scar at the base of the thumb. The limited but enlarged area must be taken into consideration by the director.

At first this was not done, with the result that many absurdities were thrown on the screen. In

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the early days the actors were not required to speak the lines they were supposed to be interpreting, with the result that the characters may be to all intents and purposes in a death struggle, the villain, according to the subtitle, hissing, "Now you shall pay for your heinous crimes," but, not feeling the scene so acutely as his audience, his lips might be framing, "Take care there, Ed, that you don't back into the goldfish."

When enlarged views, or close-ups, as they have been called, came to the aid of the director, theater managers were surprised in the midst of a tense scene to hear some of their audience burst into guffaws of delight. Inquiry proved that the individuals unable to contain their merriment, although on the screen a bitter struggle was going on, were deaf mutes able to read words that the lips were forming. Immediately to them the story became comedy.

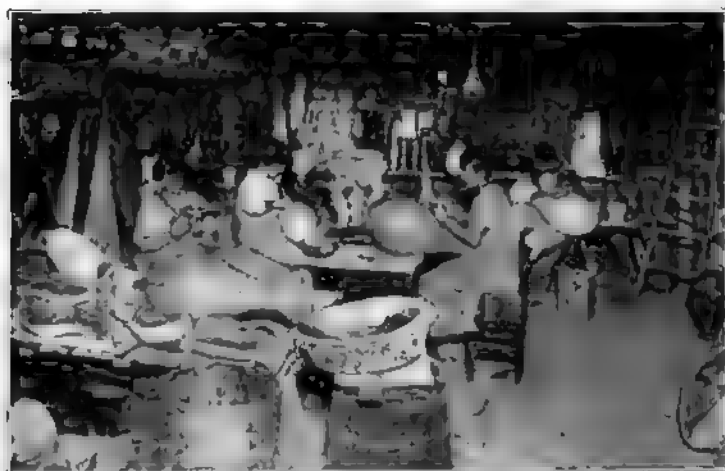
Now, however, the characters say the lines ascribed to them in the subtitles. This not only helps the characters to get into the mood of the situation, but when the words are flashed on a few seconds ahead of the actual scene, it gives the audience the chance to follow the lips as they form the words.

The reading-matter on a film—subtitles, as they are commonly known—whether words spoken by the characters or the insertions of the dramatist to show change of scene, lapse of time, or what not, necessarily interferes with the action of the play just that much. As pointed out in connection with "The Great Train Robbery," the ideal film

IN A DAY'S WORK

is one where the audience is not distracted by reading of any kind. Then the motion picture is a universal language. Such a film could be interpreted by the people of any country, whether or not they could read even their own language.

The showing of a simple sentence interferes seriously with the progress of the story, requiring, as it



VASES, FIGURES, AND BUSTS OF SHAKESPEARE ALIKE COME FROM THE SCULPTURAL DEPARTMENT

does, that a foot of film be given to each word in the sentence, with the result that often a tenth of the footage is devoted to reading-matter. Reading-matter is allowed to stay on the screen a seemingly unnecessary time, as regarded by quicker minds, so that the meaning may be clear to the slowest mind in the audience. In films showing reptiles and unpleasant crawling animals the amount of time the title stays on the screen is not to meet the demands of the slow readers, but to meet the de-

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mands of the law, for in some states there is a law to the effect that a title of thirty feet must precede all scenes exhibiting snakes. Such is done in order to get nervous persons acquainted with what they are to see, to allow them to pass out or make any preparation they see fit.

No greater boon has simplified spelling had than that given to it by the motion-picture industry. Seeking a way to make every foot of film tell a story, the manufacturers began to choose the simplest forms of words. "Programme" became "program," "catalogue" became "catalog," and the "Field of Honour" became the "Field of Honor." Preterits calling for "ed" were changed to "t," with the result that a scene was no longer "dressed," but "drest." By so doing one company estimated that it would mean a saving to it of two hundred thousand feet of film a year.

An even more important change has been effected by introducing efficiency management into the production end which had been conducted temperamentally rather than scientifically. With the rise of competition, business has come to dominate production more and more. A director is no longer able to put on a picture without regard to cost.

Cost is now studied from the time of the acceptance of the scenario until the complete film is put into the hands of the exhibitors. On the acceptance of a scenario copies of it are made and passed to the different heads who shall figure in its production. Each person receiving a copy must sign to show that it has come into his or her possession. The sheet reads:

IN A DAY'S WORK

Title..... Date.....

Received the above script:

Signed by:

Production manager.....

Director.....

Property manager.....

Stage manager.....

Studio manager.....

Art director.....

Casting director.....

Location director.....

Costumer.....

Modiste.....

Camera man.....

Leads.....

Leads.....

Leads.....

With this signed no person in active production of the picture can offer an excuse as to failure of notification.

The day of production is set and on that morning the studio manager is to have his scenes ready, that the cast may proceed at once to the filming. Each day the director must make out a report sheet that will show the producing manager the status of his work at a glance. The sheet reads:

Name of director.....

Title of picture.....

Number of studio used.....

Assistant director.....

Camera man.....

Special stock. Extra stock. Part played. Pay.

Scenes. Footage.

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Names of actors.

Name.....

Name.....

Name.....

Name.....

Number of stills taken to-day.....

Number of scenes taken to-day.....

Total footage taken to-day.....

Net footage taken to-day.....

Total scenes in script.....

Number of scenes yet to be taken.....

Estimated days to finish.....

Number of hours worked to-day.....

On the wall of the general manager's office is a diagram-board by which he may, sitting at his desk, see at a glance the status of the work for the whole studio. At the top are given the names of the directors, as shown in the accompanying photograph, with the name of the first one, Earle. Down the board are numberings corresponding to the numerical days of the month. Pasteboard disks hanging on the hooks corresponding to the day of the month show how many actors are working, whether they are in the studio or on location, and when the picture will probably be finished. As shown by the row of disks being put in place by the character in the picture, the photograph was made on the twenty-fifth day of the month.

Systematic accounting of every dollar spent in the production of a picture is fast eliminating the reckless director of the early days who gave no thought to expense. By referring to the expense sheets one director may be checked up against an-

IN A DAY'S WORK

other. One director may be able only to produce a picture at a cost of \$2.60 a foot, while another director working in a studio alongside will aggregate a cost of only \$2.20 a foot. Which produces



PRODUCTION-BOARD SHOWING NAMES OF DIFFERENT DIRECTORS AND THE PROGRESS OF THEIR WORK

At a moment's glance it may be told how many actors are at work, how many scenes they have completed, and whether they are in the studio or out working on exteriors.

the better film from a dramatic point of view is a matter of judgment, but the matter of cost is one of figures.

Directors once lavish in the use of automobiles are no longer so, for by the automobile time-slip the general manager is able to see what each director has spent on automobiles. One director may be able to get his cast in three cars to go to a location; while another director employing the same

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number of people requires four. On leaving the studio the director signs for the number of company cars he takes out, while on the slip the time-clock imprints the hour, so that the slip not only shows the number of cars being used, but the time they are out. For a company car a charge of three dollars an hour is marked against the director, while if he can get outside conveyances at a lower rate he is privileged to do so.

In the costume department a director is charged up so much a day for each gown used, and thus through all the departments he is charged for the materials used in the production of his picture. When the picture is completed the amounts are added up and a footage rate determined, and thus one director is compared with another from the point of view of expenditure. Later from the sales office a report is turned in as to which director shows the greatest number of sales, so that the value of one director over another is shown to the board of directors by an uncompromising line of figures.

But to all of this the actor has to give no concern. He and members of the cast have only to think of the appearance they make before the camera. When a cast is working the hour most looked forward to is that of lunch, for it not only means food after a taxing morning, but rest and sociability. However, even under the most favorable circumstances it is not a business man's lunch which brings him leisurely back to the office at three. While the light is up, the best advantage must be taken of it, especially if little has been accom-



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**LUNCH BY THE ROADSIDE EATEN IN COSTUME IS OFTEN A STARTLING
SIGHT TO PASSING AUTOMOBILISTS**

To the left may be seen Charlie Chaplin giving his attention to a sandwich.



THE CAST AT LUNCH

The actors eat in make-up, presenting a startling conglomeration of humanity. The lunch-room is usually in the studio building and operated at cost by the picture company.

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plished during the morning. On location the food is brought along, each person furnishing his own, the meal often consisting of nothing more than a sandwich. In the photograph, a comedy company may be seen taking advantage of a meridional respite to dispose of a few crackers and sandwiches. To the extreme left Charlie Chaplin may be seen in make-up seriously intent on a sandwich.

At noon actors and supernumeraries working in interiors or in studio sets go to the company lunch-room, where food is supplied at a nominal cost. No more picturesque scene is to be found around a producing plant than that of varied types lunching in costume. In make-up and in character they come to the lunch-room, cowboy and policeman felicitating each other over some successful prank, with the violet and the human spider of a preceding scene exchanging confidences over a plate of beans.

VII

HOW TRICK PICTURES ARE MADE

IN the early days it was considered necessary to employ trick pictures to hold the attention of the audience. So little faith did the manufacturer have in the entertaining powers of motion pictures that they bent their attention to perfecting some unusual device to stimulate interest in the films. As a result some startling effects were secured.

It was not yet realized that an audience would be content to sit and watch the gradual unfolding of a plot with the consequent crossing of purpose and clash of will of the characters involved. To hold the attention of the audience it was considered necessary to mystify them as to how certain effects were secured. It was held that the audience would be more interested in seeing a character jump into the top of a tree than in an explanation of why such a desire on the character's part was paramount. Consequently, little attention was given to motive—physical action as shown in disappearing princesses and runaway wheelbarrows consuming the greater part of the space.

Knowing that they were dealing with a medium that was essentially one of illusion, the early manufacturers took advantage of the means it offered

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to mystify still more deeply the first audience. The principle of motion pictures was still a matter of mystery to the average person in the audience; if a character on the screen disappeared before their eyes it only deepened their amazement and stimulated further attendance on their part.

The manufacturers, knowing that the witnessing of even the most simple subject was a matter of illusion, heightened the effect by having the character accomplish some unusual feat such as to climb the side of the Flatiron Building with an umbrella under his arm, confident that the amazement aroused in the breast of the spectator would hold until the following week's change of program, with sufficient stimulation to insure his return.

A film made by Melies, of Paris, and brought to this country aroused much interest as to how it was done. It told of a man who had given way to his weaker nature and partaken of too much stimulant, with the result that when he started home he had lost all interest in actualities. At peace with the world, he lay down in the middle of the street and, pillowing his head on the curb, gave himself up to morphic delights. He had not long to partake of this unconventional joy, for a taxicab, coming up, ran over him, cutting off his legs.

Aroused by the contact of the vehicle with the prostrate man, the passenger inside called to the driver to stop. Getting out, the man surveyed the unfortunate with his legs so completely severed. Hastening back to the cab, he returned with his medical bag and, supporting the man on his knee, gave him an elixir that soon brought the inebriate

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to. Sitting up, the man pulled on one leg, stood up on it to see that it met with expectations, and, satisfied, drew on the other. Brushing off his clothes and adjusting his collar, the man started off down the street. Satisfied with his work, the doctor closed his black bag and gave word to the driver to proceed with the journey.

Mystifying as the picture was to the audience, its accomplishing was a comparatively simple matter. It was merely a matter of two characters for one person's part. A cripple, whose legs had been cut off, was found and an actor made up to look like him. The two worked together in taking the picture. The actor, wearing similar clothes and bedecked with the same facial hirsute adornments, lay down in the middle of the street. Just as the taxi touched his legs the cab was halted and also the taking of the film was stopped. The outlines that the man was lying in were chalked on the pavement and the actor removed from the picture. Into the picture was brought the cripple, care being taken



LIGHT-TROUGH, AT BOTTOM
Showing how illumination is furnished at night.

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to place him in the positions revealed by the chalked outlines. His artificial legs were pushed far enough away so that even the most doubtful in the audience would be convinced that they were fully severed. The cab was advanced, stopped, and the doctor got out, the camera in the mean time registering the scene. Just as the cripple began to pull on his legs the camera was stopped once more, the cripple taken out, and the actor put in his place and the story finished with the professional.

The change from one character to the other was so rapid in the picture as to be beyond the powers of the eye to detect. On one frame was the actor and on the next frame, as revealed the sixteenth part of a second later, was the cripple lying with his legs pushed so convincingly far away that none could doubt the gravity of the accident. The audience left without knowing that the whole effect had been secured by having two persons for one man's part, convinced once more that with enough money one could get people to do anything!

The simple and now seemingly obvious discovery that the slower a film was taken the faster the action would be when projected on the screen stimulated the taking of the first trick film. As explained, the reason this effect resulted when thrown on the screen lay in the fact that if sixty frames were required to show a man walking across the floor at the normal rate of speed, by slowing down the speed with which the picture was taken till only forty frames were used, the man would suddenly display unexpected powers of locomotion. Even so simple a trick as this mystified many audi-

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ences, for the effect could be used to humorous advantage. One film depicted the construction superintendent, in the building of a house, driven to desperation by the slowness with which the hod-carriers went about their work, who invented an elixir that lent unexpected vigor to the persons taking it. Unknown to the workmen, he put some of his new-found elixir in their beer, with the result that the men ran up and down the ladders with the agility of squirrels, much to the amusement and mystification of the audience.

The same method is used to-day in the companies specializing in extravagant comedies who wish to show some person or some subject progressing with unusual speed. Instance of its use may be seen in scenes showing a man, troubled in finding his way home from the club where he had sought to forget the distractions of the day, driving his car around and around a lamp-post at a speed more suitable for a race-course than for conventional homeward travel. As may be seen, the explanation lay in the exposing of the film at a low rate of speed and its projection at a higher one.

From this single start trick films involving the same principles were made that baffled even the most analytical in the audience. One in particular showed an inventor in his garret working over a device that would attract humans in the way that metal chips are attracted by a magnet, when the landlord appears and demands his rent. The inventor does not have it, whereupon the landlord begins tossing everything out of the window, while the inventor pleads with him to give him just a

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few days longer. But the landlord is obdurate and, seizing the invention, throws it out on the sidewalk, while the inventor hurries down to take the instrument into his arms. The blow is just the touch needed. The machine will now work. Winding it up, he turns its power on the landlord, with the result that the landlord is jerked to him with astonishing rapidity. The inventor has but to run ahead a few yards, turn the instrument on the owner, who leaps to him with the rapidity of a bar of iron going to its magnet. The inventor starts down the street with the landlord struggling to get away, but each time the inventor turns it on him and presses the button the man flies back to him, snatching at trees, lamp-posts, and passing pedestrians to delay his progress. The man gets in a cab, but the inventor turns it on him; cab, driver, horse, and fare are all drawn to him. The man gets aboard a street-car, which in turn comes under the influence of the new invention. The inventor starts to walk down the street. Traffic follows him. Cab-drivers no longer having control of their movements, street-car motormen being at the mercy of the invention, and even tall and silk-hatted judges suddenly evidencing a frantic desire to climb into the arms of the inventor. Finally the inventor disposes of the landlord by dropping him through a manhole—to the satisfaction of all concerned.

What made the film all the more mystifying to the audience was that here and there in the street a cab would be going along at a leisurely pace, the driver drooping in his seat, wholly unaffected by

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the excitement of the pedestrians and vehicles. While every other vehicle in sight, including the street-cars, would be rushing down the street at the heels of the inventor, this particular cabby would



AN ORIENTAL CITY MADE OUT OF PLASTER OF PARIS. USED IN "DAUGHTER OF THE GODS"

In the middle foreground may be seen the cameras mounted on a truck pushed by men.

leisurely light a pipe, in no way concerned by the unusual activities of the people about him.

The explanation was simple, being merely an elaboration of the principle by which the construction superintendent invigorated his hod-carriers.

The studio scene where the inventor turned the influence of his device on the landlord, drawing him to him, was merely that of slow exposure and quickened projection. The difficulty that presented itself was in the street scene, where, naturally, it would

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be impossible to take liberties with an unpaid and unposed crowd. To show this hastened action it was necessary to make two pictures, and by that is meant two negatives. It must be recalled that a negative is the film which is exposed to the light, reproducing its impression, and the positive is the print made from the exposed film as in still photography.

First a camera was set up in the early-morning hours on the street and a picture taken, at the normal rate of speed, showing a sleepy cabman wending his way, stopping to light his pipe and continuing with no interest in the accustomed scenes around him.

Into the dark room, the negative was taken and an under-exposed print made so that on the positive might be seen the slow-moving vehicle and the sleepy driver. The print as now revealed showed only the early-morning scenes.

Later in the day another picture was made from the same location, the tips of the tripod being planted in corresponding positions, so that the camera would record the buildings and stationary objects on the same part of the film. Into the picture then came the posed characters—the inventor, the landlord, and the paid driver of a cab. Coming and going were the carriages and cabs and pedestrians. This negative was taken at increased speed, and when developed every third frame was cut out, so that instead of seeing a man make six steps he would be seen making only three, the intermittent frames being removed and the resulting negative carefully patched together. This



THE SCENARIO CALLED FOR THE FLOODING AND WASHING AWAY, BY THE BURSTING OF A DAM, OF A NUMBER OF PEOPLE SITTING IN A CAFÉ
This was accomplished by making a sluice to guide the water, with the camera man safely out of the flood's way.



AS FAR AS THE AUDIENCE KNEW A REAL DAM BURST, BUT AS A MATTER OF FACT IT WAS A TANK ON A PLATFORM
The tank is here shown being hauled into place by a railroad engine.

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entailed no end of painstaking and skilled labor, for the slightest inaccuracy in patching would show on the screen.

The negative, with every other frame now eliminated, was taken to the dark room and put through the process of "double printing." The positive with the slow-moving vehicle on it was put in the printing-machine and the negative with the fast-moving scenes was printed on top of it, both so timed in exposure as to give accurate reproductions. Close observation would reveal that the stationary objects, such as the buildings, were more fortunate in detail than the moving objects, but with the brief time allowed the audience for observation, few, if any, noticed the discrepancy. The film as revealed in its entirety, then, showed the familiar landmarks standing serenely above a scene that mystified all except a few professional photographers, for it showed the inventor commanding at will any person that he saw fit to turn his machine upon, each person in turn running wildly after him, seemingly clamorous to fly into his arms, while here and there, slowly moving along the street, were cabmen who gave not the slightest heed to the unusual scenes about them. These, of course, were the ones taken in the early-morning hours on the first negative.

The complete picture had meant the exposure of two pieces of negative, the tampering with one and the exposure of the two on one positive, which was shown to the audience. The scenes were easy to take, their simplicity being exceeded only by the perplexity of the audience.

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Now that the audiences had a taste of the trick pictures, they could not get enough of them, the manufacturers prompt to do all they could to encourage this longing. The other ends of the business were neglected to give the public what had struck



WORKING OUT THE BUSINESS OF A SCENE. GEORGE M. COHAN WITH ARMS FOLDED

The stenographer takes down notes as the course of the play is decided on.

its fancy. As a result many unusual films were made, all based on some element of trick photography.

The success of double printing led to applications of "double exposure"—a process long practised by still photographers. An early double exposure in ordinary photography had been made by C. Francis Jenkins which showed himself riding a tandem bicycle, so popular at that time. The

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picture, an ordinary 4 x 5, showed him sitting on both seats of the bicycle. It had been accomplished by masking one-half the lens with a piece of paper, which left half of the film exposed to the light. Thus he was able to show himself on the back seat; by removing the paper mask from that side of the lens and putting it on the other side and exposing this half of the negative he was by this simple means able to reproduce himself with startling realism as occupying two places at the same time—a feat held impossible by Neoplatonists—well-meaning men who knew nothing of the wonder-working possibilities of photography.

If double exposure could be used to reproduce two objects taken at different times on the same negative, why could it not be used in motion-picture photography as well?

Its first practical application was made in "The Great Train Robbery," mentioned in the third chapter. The opening scene was a studio set put up by the carpenters, showing a railroad station with the operator at the keys. Two masked men enter and order him to have the train stopped. A realistic effect of the train arriving at the station was secured by sight of the train pulling up to the station as glimpsed through the open window. In the reproduction the sides of the car may be seen, as well as the windows above. The whole was a matter of double exposure. The studio set was taken first, with a black curtain hanging just behind the open window, so that there would be no reproduction on the negative. A few days later the second scene was made by putting a mask over

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the lens so that only an aperture could be exposed, corresponding to the window. After a number of experiments to make sure of the proper adjustments, the negative already exposed with the studio set on it was put back in the camera and run through again. The mask over the lens of the camera permitted an exposure of only the part represented by the window in the set, so that by careful adjusting of the mask the effect of a train pulling in was realistic and convincing. The two scenes were taken several days apart, but from the point of view of the audience it was a real station with a train immediately outside.

Double exposure, as this came to be called, differed from double printing in that in the former two pictures were exposed on the same negative. In double printing, however, two films were exposed, taken to the dark room, and both printed on the same strip of positive, and this positive projected for the edification of the audience.

With the discovery that a lens could be masked its use was employed in not only trick pictures, but in the more accepted forms. One of its commonest uses was that of taking the point of view of the observer. Standing on the deck of a ship, the captain wished to call the attention of another to a ship at some distance. He handed the person a pair of binoculars. Immediately the audience would seem to be looking through the pair of binoculars with the character. The illusion was made more perfect by the restricted vision of the two round holes. Naturally a pair of binoculars was not adjusted to the camera and the picture

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taken, as some in the audience imagined. The effect was secured by cutting a brass plate and putting it over the lens, with the apertures to correspond to those of the binoculars. Similar effects of a person looking through a keyhole were obtained, not by photographing through a keyhole, but by masking the lens.

The success accorded trick pictures stimulated the manufacturers to renewed efforts, with the result that startling effects were secured. The manufacture of trick pictures was taken up and developed as the then most promising field of the business, for even the manufacturers had not been fully convinced that motion pictures were not merely a passing fancy and that any day the public would not turn to some new form of amusement.

One of the earliest pictures detailed the adventures of a Speed Fiend who cared not for the restraining hand of authority. His greatest pleasure was to outwit the motor officers.

Bringing out his car one day, he started down the street at his accustomed speed, when an officer signaled him to stop. His answer was to bring his thumb to his nose in a taunt of derision calculated to do nothing to further personal regard. While his attention was centered on the first officer he did not see a second officer commanding him to stop from the hazardous position of the center of the street. Feeling the impact against his machine, he looked back to see the second officer mashed out on the street to a thinness approaching that of a sheet of paper. Alarmed at what he had done,



BY THE STEPS MAE MURRAY ASCENDS TO THE TOP OF THE TREE, WHERE SHE IS PHOTOGRAPHED IN A PLAY LAID IN THE TIME OF THE MORMONS

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he gave his machine more power, thinking only of escape.

The first officer, coming up to where the second officer lay flattened out on the street, propped him up as if he were a piece of cardboard, chafed his hands and worked his arms until the officer resumed his customary dimensions. Then the two in another car started in pursuit, rapidly gaining on the Speed Fiend, who had suffered a burst tire. The tire was fixed just in time for the Speed Fiend to be off a short distance ahead of the pursuers. Down a side-road the Speed Fiend started, soon to find himself at the edge of a precipice, with the pursuers closing the other end of the road. In looking about for a way out of his dilemma his eye fell on the moon. Round and round he rode, far from pursuers. Standing up and shading his eyes, he caught sight of Saturn and its surrounding ring. Immediately he wished to possess it. Starting his car, he waited until it was going at a burst of speed, and then sailed through the intermediate distance, landing safely on Saturn's ring, while round and round he rode as if the ring had been a race-course put there for his own special edification. Turning now and then to the two perplexed officers standing at the cliff's brink, he again brought his thumb to his nose in an act of inclusive derision. But his triumph was not to be for long, as soon outraged justice was to be avenged, for off came one of the wheels of his car, precipitating him off Saturn and headlong through space until he landed in a haystack almost at the officers' feet. To the station and justice they took him, the former

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motorist content after that with the speed that might be obtained from a bicycle.

The making of the film was not the stellar matter that the audience was prone to believe. The running over of the officer was merely a matter of exposing the film at a slow rate of speed; the idea that the officer had been run over was given by the officer clinging to the under part of the car, dropping at the same time a strip of cloth painted to look as if he had been run over and mashed out to an impossible thinness. When the car had passed on the only evidence of the remains of the officer was the strip of cloth. The other officer rolled it up and by means of the "hold" (later to be explained) the real officer was made to materialize.

In pursuit the two officers started. When the fleeing motorist reached the precipice the scene was transferred to the studio and the rest of the picture finished within its walls. The following scenes were all interiors.

When the car was launched into space the film was recording only the trip of a miniature—a duplicate of the real car and driver in every way except that of size. In the car was seated a small dummy of the driver made to scale. The moon, located at an adventurous distance of twenty feet, was another model. The sky with its stars and Milky Way was stretched on boards.

After his ride over the moon the driver leaped to Saturn, ten feet away, the model being suspended on wires and photographed during its flight. Around and around the rim of Saturn the small car sped, operated by invisible wires; the dummy's hand

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was brought up for its mockery by wires and the wheel slipped off by the same means. The whole was taken with a short-focus lens, so that the model of the car and the man seemed life size when shown to the mystified audience.

Instant success met this film, with the result that the market was flooded with stories wherein the moon was involved. No studio was considered complete without its lunar property. To show the flight of a man to the moon merely meant turning through the alphabetical set list to "M" and telling the carpenter where to hang it.

In experimenting with trick films the principle of what came to be known as "stop crank" was discovered, which allowed the manufacturer to display to audiences new surprises. By it a fountain pen could be made to write a letter without the aid of the guiding hand, or a pair of scissors could be made to walk across the floor without support.

These feats were made possible by the number of photographs that must be made to reproduce an action lasting even so short a time as a half a minute. As has been explained, motion pictures are based on the principle of sixteen pictures to a second, so that to show an action that lasted thirty seconds 480 pictures would have to be made. Between each picture there is an infinitesimal gap in time, the one sixty-fourth part of one second. Small as this is it gives the photographer so minded unending opportunity to mystify the audience.

A film putting to use this gap that mystified many an audience showed a fountain pen standing on

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its point, writing a letter. The picture was accomplished by supporting the pen in an upright position by black threads operated outside the range of the camera. These threads were made invisible by means of a black-velvet curtain which



SHOWING TRIPOD AND OUTSIDE MAT OF CAMERA. NAZIMOVA IN CHARACTER PART

allowed of no reproduction of the thread. Thus the pen was held in position. Naturally a pen could not be made to write guided only by threads, but it was thus held in position and maneuvered by means of strings as though it was actually doing the writing. The writing was done between exposures. A few frames were taken showing the pen in position and the camera stopped, the threads slackened, the pen grasped by the hand of the

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assistant and made to formulate the letter "D." The hand was removed, the threads brought tight, and the exposure of a few more frames was made with the pen being moved as if really writing by means of the threads. The camera was stopped again, and again the hand grasped the pen formulating the letter "e." This was exposed, the camera stopped, and the letter "a" put down until the salutatory "Dear Sir" was formed. The time to write and photograph the words required ten minutes, but when shown the frames were projected on the screen in the rapid order necessary to show continuous action; the time that the words appear before the audience was one and one half seconds. Naturally the camera did not show what happened between the frames while the hand was holding the pen, so what the audience saw was the pen moving up and down and the words appearing on the paper. There was no relation between the movements of the pen and the formation of the letters, but to the audience there seemed to be, and to them the pen seemed to be tracing the letters. Thus the whole epistle was written, the audience at a complete loss to know how it was done. If the audience had been able to see what happened between the frames the mystery would have been cleared up in less time than it took to formulate the opening phrase.

This method of tricking the camera is called "stop crank," by reason of the stopping of the camera and the manipulation of the object being photographed without a record of it being permitted to be exposed on the film. Reference will be made

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to stop crank in another chapter to explain further machinations of the camera.

In experimenting with stop crank its antithesis was discovered in what is known as "reverse." By means of it a man could easily jump into the top of a tree. To accomplish this he had but to stand still, take a pair of jumping-weights in his hands, inflate his chest preparatory to the strain, and then give a mighty heave, and up he would go before the eyes of the audience until he landed in the topmost branches, far above the heads of the less gifted spectators.

A film, popular during the period of development when trick films were in demand, showed a workman who fell asleep at his mortar-board and dreamed that he had invented a way to build a house by electricity. All that he needed to bring this about was a stool and a push-button. When he wanted work to begin he had but to push a button and immediately the house would begin to build itself, and before the audience the bricks were shown jumping into place and the doors jumping along their edges and climbing on to their hinges. A few more minutes and the house would have been finished, but, unfortunately, his pipe turned over in his lap, spoiling it all. "Building a House by Electricity" is still remembered by audiences yet as much mystified as then enthused.

The principle of reverse action was used throughout the picture. This principle can be explained in the simple instance of the athletic man who attained the top of a tree by means of his jumping-weights. The action was backward from what it

HOW MOTION PICTURES ARE MADE

appeared to be on the film. To make the jumping picture the man crawled to the top of the tree and the camera was focused on him. The photographer looked at the distance down that the man was to cover and estimated the number of seconds the action would take, put his hand over the lens of the camera to eliminate all light, and ran through a corresponding amount of film without exposing it. To an attachment of his camera especially constructed for trick work he fastened his crank so that the film would not proceed in the regular order, but would go backward. By his dial he could tell just how many feet of film he had run forward without exposure, and this he estimated to be enough to cover the action that was to take place.

At word from the director the man in the tree-top rose and sprang clear from the limbs, landing on the ground, the camera meanwhile recording his movements. The film that recorded his movements was run backward instead of forward by means of the crank gear especially made for such work, as explained. When it came time to show this to the audience the first frame that met their eyes was the last one taken—the one showing him striking the ground. As a result, to them he seemed to be accomplishing the startling feat of standing still and jumping into the top of a tree.

On the same principle the house built by electricity was filmed; the house was actually being torn down. The bricks were photographed being shoved out of the wall by a hand out of sight of the camera and the film reversed in the showing.

HOW TRICK PICTURES ARE MADE

As cinematographic art advanced and as plot and purpose in narration began to take the place of mystifying incident, the demand for trick films began to grow less. Trick work was only a means to an end. It was found that audiences were more interested in stories depicting conflicts and strug-



ROOMS SO ARRANGED THAT THE CHARACTERS MAY WALK OUT OF ONE INTO THE OTHER TO GIVE THE IDEA OF SPACIOUSNESS

Overhead may be seen canvas diffusers for regulating the amount of sunlight.

gles than in a table setting itself. As a result pure trick films began to disappear from the market.

Experimenting only to mystify audiences, new and valuable camera methods were discovered which have come to be used more and more in accepted photography. By such methods photographic effects are secured little understood by an average observer. It was in such experiments that the principle of fade was discovered, by means of which a scene could be made gradually to grow plainer until the full details were before the audi-

HOW MOTION PICTURES ARE MADE

ence. This in photographic parlance came to be known as the fade-in. A fade-in might show a splotch of high light which slowly takes on detail until it is seen that it is moonlight on a girl's hair, and then as the details grow more distinct the girl is seen sitting in a French window, her chin on her hand, waiting for her lover. Slowly the details of the picture are faded in until not only the girl's features are plain, but also the surrounding setting. The reverse of this—the gradual elimination of the scene—came to be known as fade-out. By the simple process of fade-in and fade-out additional trick and art effects were opened up to motion-picture photography.

Fading in or out is accomplished by four different methods. The simplest and most commonly used one is that of the closing or opening of the diaphragm in the lens. This lets in less light, with a gradual dimming of the details of the picture. However, the diaphragm fade is open to the objection that with an iris that never closes completely it is impossible to make a complete fade. This is especially true in brightly lighted locations where the light is free to stream in the opening.

The second means of accomplishing a fade picture is by means of the dissolving shutter, which has an advantage over the diaphragm fade by reason of being able to make the image fade uniformly and completely away. The dissolving shutter is a mechanical device which, while the shutter is revolving, is closed by a blade slowly passing over the opening until it is entirely closed. One or two cameras come equipped with such a shutter

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fading device, although almost any camera can be equipped with one by a mechanic of some ingenuity at a cost approximating something like a hundred dollars.

This shutter device for fading out a picture may be operated automatically or by hand. In the latter the shutter is controlled by a lever with a graduated arc which indicates the shutter opening, so that the operator may know with what intensity the light is flooding his picture. The automatic device is operated by a push-button which throws in a clutch on a screw, which in turn operates the shutter blades. The operating-screw is of a certain length, so that the picture fades in a previously determined number of feet—varying from two to five. The operator pushes the button and continues to turn his crank, giving no further attention to the fading of the picture. However, the hand-operated device has the advantage of permitting a slow or a quick fade as the light and the exigencies of the situation inspire.

The third method of securing the same effect is by means of a graduated screen. This consists of a strip of glass fitted in a grooveway moving in front of the lens of the camera, varying in intensity from clear glass at one end to complete opacity at the other. By moving this graduated glass strip in front of the lens the light is cut off at will, with a gradual diminution of the details of the picture until complete obfuscation is secured.

The fourth method of fading a picture is by means of a chemical process. An even and desirable fade is difficult to secure by this method by

HOW MOTION PICTURES ARE MADE

reason of the uneven action of the chemicals. The solution most commonly used in the fading process is one of cyanide of potash with a tincture of iodine.

With the four methods of fading a scene either in or out, a number of photographic effects are secured not usually understood by a casual observer in an audience. The commonest of these is the so-called "dissolve," by which the figures of the scene gradually disappear while those of a succeeding scene slowly take their place. The picture may be that of an old-fashioned barn dance, and, while the observer looks, the figures slowly become more and more indistinct while the figures of a fashionable city dance take their place. The effect is secured by slowly fading out the barn-dance scene by either one of the four methods enumerated, and then covering the lens so that no light will enter and then turning the film back to where the scene began to fade. The new scene is now photographed; the barn-dance set has been cleared and the same actors or others appear in the fashionable setting. The cap is removed from the lens and that part of the film is exposed a second time with the figures of the fashionable gathering growing more and more distinct until they appear in full light.

Such a means of changing from one scene to another came into use by reason of the less tiring effect on the eye. With a sudden leap from one scene and one set of characters to another it took the eye some moments to adjust itself to the new lighting and figures. With the slow dissolve from one scene to another the eye had a greater length

HOW TRICK PICTURES ARE MADE

of time to accustom itself to the changed condition.

A further effect may be secured in the matter of a dissolve by an outside diaphragm mounted on an extensible lens hood on the camera. By closing the iris diaphragm an effect is secured of the image gradually disappearing at the corners of the frame and gradually diminishing in a circular form to a mere dot, itself finally to disappear in the inclosing blackness. The sharpness of the edge of the circle is determined by the distance between the outside diaphragm and the lens, as well as by the lens aperture. By means of this circling-in diaphragm the expression of a single actor in a group may be isolated from those around him.

By means of the dissolve a character may be made to appear slowly on a scene, but if the story demands instantaneous materialization the effect is secured by a photographic means usually known as "the hold." It is so called by reason of the fact that all the other characters in such a scene must hold their positions while the trick character is made to materialize. The dissolve is more commonly used, as the effect is more pleasing and as the character may be made slowly to appear before the audience, but if the scene demands a sudden appearance, as in a comedy or fairy film, the character is often introduced by a puff of smoke. A small charge of powder is set at a prearranged spot on the stage, or an outside location, and the scene proceeds as usual until the moment for the entrance of the comedy character or of the witch who is suddenly to appear out of nothing. At com-

HOW MOTION PICTURES ARE MADE

mand of the director all of the characters assume rigid poses, while the camera is stopped. Into the scene is brought the comedian or witch. The powder is exploded by closing an electrical switch off stage. With the rise of the puff of smoke the witch leaps into the air, while the director calls, "Camera!" With that the characters on the stage who have been holding their positions again begin to move. An audience watching the scene does not realize how the flesh-and-blood character was made to appear out of a puff of smoke, for the reason that the audience is not aware that there has been a pause in the scene, with the characters holding their positions, while the witch was brought on. To the audience the action has been continuous.

However, if there is a long wait to arrange the scene or assume a costume for the materialization of the witch—a wait of twenty minutes during which time it would be difficult for the actors to keep their original positions—the demands of the situation are met by chalking on the floor the outlines of the soles of the actors' shoes and by the actors carrying in their minds the positions of their heads and hands. In this way a scene may even be carried over to the following day without an audience realizing that there has been a break in the continuity of the photographing.

Scenes making use of double exposure, or dissolves wherein the character appears, are often accomplished on a neutral background to eliminate all possibility of an audience seeing anything except what the director wishes it to see. A black-velvet curtain is usually used for a neutral background,

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for the reason that black velvet absorbs more light than any other material easily available. However, it does not absorb all of it, so the velvet is stretched tight so that the folds and wrinkles will not be visible. Additional means are often employed to make the background neutral by employing a "shadow-box." A shadow-box is a cube with one side open, large enough to permit the movements of an actor. The sides of the box keep out the light, so that the neutrality of the painted drop, or of the black velvet, as the case may be, is added to by the resultant shutting off of the light.

The most common photographic expedient in motion pictures requiring trick work is that of the vision where a scene removed in time and action is made to appear at the expense of other action. A bachelor sitting at his fireside may close his eyes and, falling into a doze, have brought to his mind scenes of his childhood or of bygone sweethearts. As first taken in the early days of motion-picture photography, the scene was twice exposed. Unobserved by the audience, the fireplace was one of neutral background with wide space either to the right or left of him. Often the background was hanging velvet. The film was once exposed with the bachelor in his chair. The film was then reversed a second time, with the scenes supposed to be taking place in his mind appearing on the neutral background. Later, with the coming of improved methods, a mask was used to obscure part of the field so that the bachelor alone would appear. The rest of the background was concealed by the mask and as a result left unexposed. By

HOW MOTION PICTURES ARE MADE

taking out the mask and turning back the film a new scene could be exposed on the protected background. Masks for such work are either interior or outside masks. By outside mask is meant a mask that is put in place on the outside of the camera—between the object or character being photographed and the film. An interior mask is one set in place between the lens and the film. Such masks are cut in a wide variety of shapes. The commonest forms are those representing a character gazing through a pair of binoculars, with other forms in the shape of keyholes, stars, hearts, maple leaves, and such others as the photographer feels inspired to make.

It is by such masks that an actor may be made to shake hands with himself. Over the lens a mask is placed which cuts off the light from half of the stage scene. A spot has been previously arranged where the actual handclasp is to take place. Such a place may be over a book on the table, or directly under a hanging chandelier. The actor who is to play both parts advances to the spot where the handshake is to take place and extends his hand. On the part of the stage obscured by the mask another performer stands who extends a hand and joins that of the actor, while the two hands move up and down in manual greeting. The actor shows, the other performer is hidden by the mask. As the hands move up and down the photographer counts the number of seconds. At the count 1 the hands descend to a distance determined at rehearsals; at 2 they go up; at 3 they go down again; and at 4 they unclasp and separate.

HOW MOTION PICTURES ARE MADE

The film is turned back and the mask shifted to the other side of the lens area. The actor again makes an entrance and extends his hand over the book, or under the chandelier, as the case may be, but as the handshake has already taken place he merely pretends that he is going through the usual form of greeting. He moves his hand up and down and frames the words, but he must move his hand exactly as the performer shielded by the mask has done. His hand goes down on the count 1, up 2, and so through the scene, exercising care to move it exactly as the performer did. If his action is not an exact duplicate of the performer's movements, the scene will be made ludicrous, for it will look as if the man has had his hand shaken off.

Projected successfully, the actor, much to the mystification of the audience, seems to advance from two sides of the scene at the same time and stop in the middle to shake hands with himself with all the enthusiasm of two long-separated friends. Without knowledge of photographic expedience, the audience does not know that the picture was taken by means of masks over the lens and in two different scenes, thus simplifying the seeming startling phenomenon that one body is occupying two opposing positions in space at one and the same time.

VIII

THE THINGS THAT MYSTIFY AUDIENCES

WITH the disappearance of the trick film for purposes of pure trickery, there came into use means and methods of illusion that were not of themselves matters of photographic manipulation. A film was no longer used just because it mystified the audience. The trick work in it had to be germane to the general plot of the story.

Such is the trick work as found in the films of to-day. It is not trickery for itself, but trickery for an end.

There is and always will be double exposure, but there is little likelihood that again a whole film will be built up of double or multiple exposures. Instead of occupying half the story as it once did, the double-exposure scenes now occupy but a few feet. In fact, double exposure is used constantly in the course of a photoplay without the audience giving it a thought, for it is used now in dissolving from one scene to another. In the early days of the industry the scene changed from one set to another without any preliminary dissolve, with the result that the eye suffered a shock. The audience would be looking at a rider climbing a steep mountain path, and then without warning and without

THE THINGS THAT MYSTIFY AUDIENCES

intermediate change it would be whisked in the sixty-fourth part of a second to a comic character listening at a keyhole. To-day the change is often bridged over by having a gradual dissolve from one scene to another. This is accomplished



SPIRITS AND VISIONS ARE MADE TO COME AND GO AT WILL OF THE DIRECTOR BY THE SIMPLE MATTER OF DOUBLE OR MULTIPLE EXPOSURE. For this scene the film was exposed twice, with the girl in both times, but with the other characters in but once.

by running the last two or three feet of the film through with a mask on the lens, and then backing up the film and running the same length through on the opening of the second scene. In this way there are actually two scenes showing on the same strip of negative, but the dissolve is so slow as to be pleasing. The slow change has eliminated the shock.

HOW MOTION PICTURES ARE MADE

This is accomplished by means of double exposure, but the audience with its attention centered on the story gives it little notice; when the same effect is made much of, it is at a loss to know how it is done. In the picture herewith reproduced, showing a girl sitting on the step and seeing in a vision her lover and Christ in the same scene, the audience is mystified and wonders how it was done, when no thought is given to the gradual dissolve from one scene to another. The first scene exposed on the film was that of the girl sitting on the step; a stop-watch showed to the fractional part of a second just how long the scene lasted. The film was then run backward to where it originally started as shown by the measuring-dial and the two actors brought on, the one on the left taking the part of her lover and the one on the right assuming the rôle of Christ. Again the same film was run through, but this time under-exposed. The girl sat through without change of position, so that she comes out sharp and clear in every detail, while the two characters brought on only for the second exposure show in shadowy outlines that are very effective. In an under-exposed picture, white is the predominating color. It is the first to be seen and the last to fade. As may be seen here, the black of the lover's clothes fades gradually out, while the white collar, cuffs and hands remain distinct.

The set is that of the outside of a building. The brick, it is interesting to note, exists only by grace of the scene-painter.

Oftentimes the effect of a double exposure is

THE THINGS THAT MYSTIFY AUDIENCES

ruined by a bit of misplaced white, as may be seen in the photograph of the scene from Dickens's "Great Expectations." Double or multiple exposures are taken on a black background in order



AN IMPERFECT DOUBLE EXPOSURE—MADE SO BY THE SPLOTCH OF WHITE ON THE WALL

From Dickens's "Great Expectations."

that the details of the second exposure may stand out sharply, as black has little photographic value. In this picture the bed scene, played by Jack Pickford, was photographed first with a mask over part of the lens. In the second exposure the knife scene was taken, which with the dull boards would make a neutral enough background to give detail and form to the under-exposure. But a mistake in

HOW MOTION PICTURES ARE MADE

photographic judgment was made in having the figure advance past the white picture hanging on the wall. The predominating white stands out to the elimination of the second exposure, destroying the value of the picture.

The author recalls a similar mistake in judgment made by the company with which he was connected, which resulted in amusement to the audience instead of the pathos that the scene was meant to inspire. The scene was that of a father dying in a rough mountaineer's cabin, the log walls lending the needed black for the double exposure. The father closed his eyes and in a vision saw his prodigal son return and come into the room where he was. The scene of the father was taken, timed by the stop-watch, and then the scene showing the son coming into the room was exposed. It was an effective and touching scene save for one thing that had escaped the eye of the director. Hanging on the wall of the cabin was a calendar, and at the most pathetic and stirring moment of the scene, when the son passed in front of the calendar, the audience was shocked at being able to see through the prodigal and read the incongruous words, "June, 1917."

Mistakes are not all confined to errors in exposure, as the author calls to mind in the case of the company with which he was connected. The scene was that of the Great Pyramid in Egypt and showed the Princess riding up to the Great Pyramid and deciding to run up its steps and secrete herself in it and evade her royal but worthless husband. An order was given to the chief carpenter to erect

THE THINGS THAT MYSTIFY AUDIENCES

the Great Pyramid back of the studio, and forthwith he proceeded with his work. It was made out of canvas, papier-maché, and cement, and to him seemed a wonderful piece of work, but when the



THE GREAT PYRAMID WAS WANTED IN A PICTURE, SO ITS CONSTRUCTION WAS TURNED OVER TO THE CHIEF CARPENTER

The carpenter followed his imagination rather than facts. The pyramid is wrong in every detail. The Great Pyramid does not have sharp edges, and there are no steps leading up.

picture was thrown on the screen it was found that the Great Pyramid did not have a flight of steps leading to its top. The only means of ascending was by stones as high as a man's waist and weighing several tons. In addition, the stones, a traveler familiar with the Pyramids pointed out, had not the fresh, sharp edges given them by the chief carpenter, but were chipped and ravaged by the

HOW MOTION PICTURES ARE MADE

passing of centuries. To an audience that had made the troubles of the Princess their own, the picture met every demand, but to those who had been to Egypt her escape from her villainous husband was a matter of merriment.

The usual number of exposures on a film is two, but the number is limited only by the demands of the story. In a story called "Shadows," King Baggot played all the parts—twelve. In one scene in the story he played six parts, which meant that the film in this particular scene was exposed six times, showing him sitting at a table dressed for six different parts and talking to himself in six different rôles.

In the picture reproduced herewith Baggot is shown playing opposite himself, taking the part of two brothers. On the left he stands with up-raised hand, which constitutes one scene, while on the right he stands beside his mother, making the second exposure. The two exposures were given the same time, so that each shows equally distinct.

The walls of this room, which, as seen behind the uplifted arm, seem so substantial, are, much to the surprise of a person visiting a motion-picture studio for the first time, made out of composition board.

Canvas was universally used in the making of sets, for the reason that canvas lent itself readily to the scene-painter and could be adapted to any shape desired, but with the high prices consequent upon the war canvas doubled many times in price, with the result that a substitute had to be found. It was found in a paper composition looking much

THE THINGS THAT MYSTIFY AUDIENCES

like linoleum, which not only made a more satisfactory wall for a room but could also be used for a floor. The use of the paper composition also did away with wall vibration, withstanding very



A HIT OF PERFECT DOUBLE EXPOSURE

In this scene the two brothers are played by the same person.

hard usage as flooring. Since the studio floors are made out of undressed lumber four inches in width, it comes as a jar to an audience to be engrossed in a Revolutionary scene and to glance at the floor to see, instead of the Colonial broad boards roughly nailed down, tongued flooring of modern construction. To give the right Revolutionary feeling, the effect is now secured by placing on the studio floor the composition covering painted and grained in the most approved way, so that the audience, seeing the knots and rings, have not the

HOW MOTION PICTURES ARE MADE

least doubt, but that they are gazing at a Revolutionary relic.

The erecting of a Revolutionary interior is an expense that a company naturally wishes to avoid if it can do so, and instead of putting up a set of a Colonial parlor as a place for the hero to clasp the girl to his bosom in a lingering farewell, so well liked by the romantic motion-picture heroes, the director often rents a real Revolutionary house and in it makes his picture. The Gaumont Company, wishing to get true detail and correct atmosphere for a Colonial picture, engaged the Bowne House in Flushing, Long Island, and took the interiors by means of portable lights brought in for the purpose, thereby making certain of eliminating all anachronism. The house was built in 1661 and is now used as a museum. The electric lights had to be placed properly, since all the illumination was side lighting, to eliminate shadows. The scene was accomplished successfully without in any way harming the guarded treasures.

To-day illusion is secured in motion pictures, not by trickery, but by what may be termed artifice. Cheap trickery has passed away for mechanical effects that give more satisfactory illusion. Instead of showing a reckless motorist seeking safety on the moon, the directors now show a real feat of skill or daring, but neglect to show the audience how it was accomplished. The feat is actually done, but how the audience does not know. In "A Daughter of the Gods" one of the scenes that the audience was at a loss to explain how it was done showed Annette Kellerman being washed over

THE THINGS THAT MYSTIFY AUDIENCES

a waterfall while her hands and feet were bound. Slowly she came over, struggling realistically before the camera, seemingly dashed from rock to rock. In the early days the picture would have been accomplished by having the camera at such a dis-



LUNCH ON LOCATION

By means of the platform it is shown how a picture can be taken of a person in the back seat of the machine while the car is moving.

tance that the audience could not be sure that a boy was not doubling in her part, but in the pictures before them they knew that this was not being done, for they could see her features all the while. Although they could see her features, there was something that the director took pains that they should not see, and that was a rope around her waist manipulated by two men behind a blind.

If the feat is too hazardous it is not attempted

HOW MOTION PICTURES ARE MADE

by the star, but by an extra doubling in his or her part, who agrees to execute the feat for a stated sum and in addition signs a statement that if injured in its accomplishment he will not hold the management responsible. Even though the leading lady might wish to do the hazardous feat, she is not permitted, for the reason that if injured it would mean costly delay in getting the film on the market. In addition to the amount of money tied up, the release date would probably be announced and bookings made, so that injury on the part of the lead would mean financial loss.

Oftentimes a feat of daring when witnessed in a studio becomes laughable by its utter remoteness from danger. A scene that never fails to thrill an audience is that of a girl standing against a wall while being hemmed about by long-bladed knives hurled by the heartless villain. As a matter of fact, the picture is taken in two different scenes. A flash shows the knife-thrower with upheld hand. Another flash shows the knife entering the wood, while the audience is fully convinced that the girl has escaped only by a miracle. (See page 197.)

The scene is accomplished in reality by the director calmly going up and placing the knives where his practised eye dictates, pushing the girl's head over if the danger doesn't seem apparent enough. To the knives, and invisible to the motion-picture camera, are fine wires, fastened to the handles by means of hooks, as may be seen in the instance of the knife outlined against the left sleeve of the girl's dress. The camera is started up and by means of reverse motion a picture is taken of

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the knives being jerked out. The last knife out, when shown on the screen, will be the first one in. When the film is joined in the cutting-room, the flash of the knife leaving the man's hand is inserted,



PREPARING TO SEND ANNETTE KELLERMAN OVER A WATERFALL

She was held in place and kept from being dashed against the rocks, while going over, by means of a rope out of sight of the audience.

followed by the part showing the knife striking the wall. The audience, as wished by the director, assumes that the knife it sees leaving the man's hand is the one that flashes into the wood, and goes home satisfied that sooner or later the girl will pay dearly for this unwarranted exposure of herself.

Often scenes beyond the comprehension of the audience are as simple in the making as they are mystifying in the presentation. Scenes wherein letters come out and hang themselves in a line or

HOW MOTION PICTURES ARE MADE

group themselves into words are a constant source of wonder to an audience.

Such scenes are to be found in motion-picture theaters announcing their own name, or in the appearance of matches that of their own volition spell out "Topical Review" or a similar heading. One scene, illustrative of the process, showed a stork picking up the different letters of the alphabet and hanging them on a clothes-line until the name Strand Theater could be read.

The scene was taken on a table with the camera hanging above, as in the instance of the animated cartoon. On the table was a drawing showing the back yard of a house with a clothes-line stretched across. In the form of a child's cut-out a stork was laid on the picture and moved about as desired. From a box of alphabet letters the required ones were taken out one at a time and placed so as to look as if hanging from the stork's bill. The stork's position was shifted on the drawing and made to go through the movements of walking and hanging the letters on the clothes-line. To show seeming movement, the legs of the stork were jointed so that they could be made to assume the positions used in walking, with a joint for the neck to be used in hanging the letters on the line. One by one the letters were shifted to the clothes-line, the stork returning each time for an additional letter until the words were spelled out. For each move a requisite number of frames were exposed, so that when shown rapidly on the screen the stork seemed to be moving and performing feats usually considered beyond its mental equipment.



AS THE AUDIENCE SEES IT



AS IT IS DONE

HOW MOTION PICTURES ARE MADE

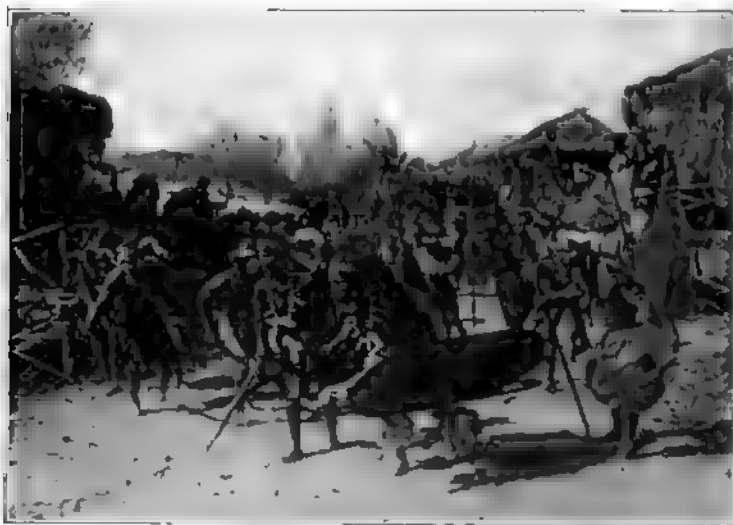
Letters to be used in animated trick photography may be bought for a few cents a dozen. Used in conjunction with a jointed cut-out they make a scene difficult to explain but easy of accomplishment.

Clever dressing and expert carpentry have taken the place of film manipulation, for by posing a scene carefully an effect can be built up that is convincing even to the most demanding in the audience. In the photograph reproduced herewith the author is shown shaking hands with a cannibal chief in the South Seas. The chief is distinguished by his head-dress, which is made out of the feathers of the oo-bird, long held sacred by the members of this particular tribe. Around him are grouped his tribesmen with their long hunting-spears, with the second chief in shorter robe to the right. The tribe has made its preparation and is ready for its "luau," at which a pig will be drowned and roasted in celebration of their victory. In the background may be seen the grass huts where the warriors live, while the author stands on the holy tapas—the woven mat used in all tribal celebrations.

The film was convincing and the source of many gasps of breathlessness on the part of the audience, thrilled at the adventure of kindred Caucasians among the ruthless black men of the South Seas, few, if any, suspecting that the chief with whom the author was shaking hands was a graduate of Oberlin College, Oberlin, Ohio, while the rest of the warriors were law-abiding natives of Honolulu, drawing two dollars a day and going home on the street-car.



CANNIBALS GET TWO DOLLARS A DAY



NEGROES SLIGHTLY ORNAMENTED MAKE SATISFACTORY ZULUS
 Designs for the war ornaments and tribal markings are got from books of travel dealing with the subject.

HOW MOTION PICTURES ARE MADE

In the early days of the motion-picture business it was considered necessary, if the story called for a South African scene, to take the cast to the country itself in order to get the proper atmosphere. In practice this was found unsatisfactory, by reason—in addition to the expense of such a long journey—of the risk to the film. If held over, there was constant danger that the emulsion would run, while if development was attempted at the time of exposure, rarely or never could clear water be had. As a result it was found more satisfactory to cast the scene in a local studio lot, whether the scene was one of Greenland or Africa.

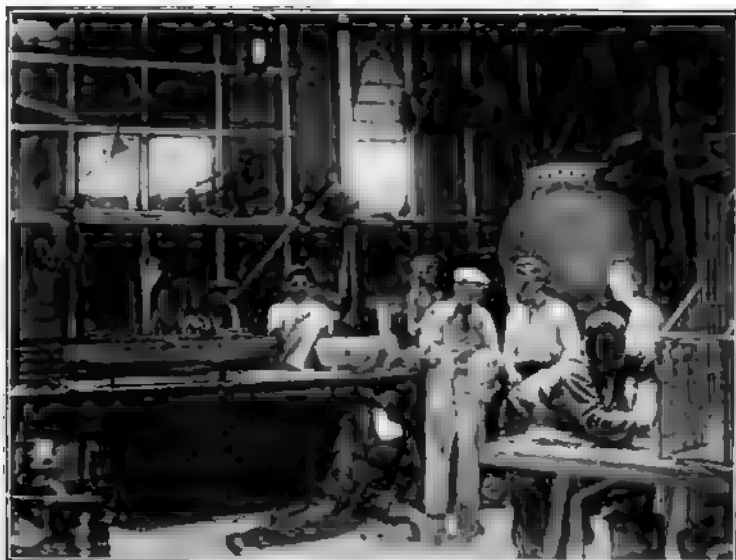
In the reproduction on page 199 an African tribe of head-hunters is seen just leaving their thatched bamboo huts to repel a raid of their enemies. It is startling, on first becoming associated with studio work, to see those same savages lined up at the paymaster's window a few hours later, signing their receipts and bearing off the spoils of war.

The pictures meet every demand of the audience, for they are true to life in that they have been carefully supervised by missionaries and returned travelers, so that when a savage carries a war-shield it is actually a duplicate of one brought from the country whose inhabitants are being portrayed on the film. To make sure that the details are true, a studio has filed away in its morgue photographs of the life it wishes to depict. If it has not a complete collection of the particular tribe or of the particular ceremonial rite it wishes to reproduce it sends to one of the large New York

THE THINGS THAT MYSTIFY AUDIENCES

photograph companies which have in stock millions of pictures, so that whatever question comes up the director is practically certain of having a photograph to clear up any doubt he may have as to detail.

Further realism is given such scenes by having



IN THE PROPERTY-ROOM

On the floor may be seen the dummy that goes over the cliff.

one or two natives from the country or countries being shown actually in the scenes, for in Los Angeles are representatives of all races. If a director wishes to show a scene of India he telephones the motion-picture-extras employment agency that he has need of all the Hindus that he can get; by the following day he has several principals to

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take the front-row parts, with negroes made up with the same ear-rings and tribal markings to play less conspicuously in the rear.

The heathen gods that directors so love to have their plots center around come not from Benares and Penang, but from the property-room, where they are not only made, but stored away for further calls. Such idols may be seen over the shoulders of the two men, while on the counter to the left may be seen a dummy battle-ship used in a war scene. The first part of the picture shows an actual battle-ship with its fighting-tops, with crew and officers coming and going, but when it comes time to sink the ship the small model, taken with a short-focus lens in the studio tank, is the one that goes to the bottom with the property loss twenty dollars. On the floor with staring ceramic eyes is the dummy ready to go over the cliff at the discretion of the director.

As may be known, the actor or actress does not make the flight when the scenario calls for a fall from a cliff. The actor goes up to the verge, the camera is stopped, and then the dummy put in a corresponding position. The camera is started with the dummy finishing the flight. The actor or actress puts himself or herself in the position at the foot of the cliff taken by the dummy. The camera is started; the real actor arises from the sand and debris, while the audience is fully convinced that it has seen the same figure from top to bottom. In producing such pictures the director and actress decide by consultation an advantageous placing of the dummy so that the audience may be

THE THINGS THAT MYSTIFY AUDIENCES

fully convinced that the lady has escaped only by a miracle.

Increasing skill in the carpentry room has made possible effects and illusions that before could not be realized even by the most ambitious director.

In the workshop are not only clever sculptors and cast-makers, but workers who can reproduce in miniature form any scene that the director wishes to show. The picture is that of a small Pennsylvania soft-coal mine, showing the elevator, the tracks, and the



WHEN THEY ARE PUSHED OFF THE RAMPARTS

Nets are used back of parapets to catch the actors who fall off. These are out of sight of the cameras, so that the audience thinks the actors have fallen a great distance.

power-house, with the dwarfed trees trying to find their way through the screenings to the black earth. A careful scrutiny of the picture will reveal interests denied to the motion-picture camera, for it may be seen that the coal-mine is setting on a platform, with props to the left holding up the struggling trees. The explanation is, of course, that it is a papier-maché model. In fact, the maché has run over the side and

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is hanging down in several places in telltale stalactites.

The scenario called for a mine explosion. From the location-book a suitable mine was looked up, arrangements made with the owners to photograph it with the actors taking the necessary parts, at the completion of which the company left, the owners little realizing that when they saw the picture the mine before their astonished eye would be hurled high into the air by the avenging villain.

Directors on the alert to find subjects of interest to the public soon saw that audiences responded quickly to the appeal of an animal in a picture. A director passing through a zoölogical garden was struck by the interest the public displayed toward the animals. The floral hall, the museum, and the bird-houses were visited by people coming and going, while the animals held the people for hours at a time. A flower was beautiful to look at, but it did not have the appeal of a thinking, moving animal. Observing further the interest displayed by Sunday audiences, he found that of all the animals the ones that were the objects of the most continued attention were the monkeys; next in interest were the elephants. The primates, more nearly approaching man in thought and action, held first place, with the wonder inspired by the size and strength of the elephant second.

He determined to make use of this knowledge in motion pictures. But when it came to a practical application of the knowledge it was found that, while monkeys were an interesting cage animal, there was little a primate could do in a picture.

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He would swing from a bar, or open a peanut, but the carrying out of these practically exhausted his possibilities. A story could not be written around a monkey as it could around an elephant, where the



AS FAR AS THE AUDIENCE KNOWS THIS IS A REAL COAL-MINE, BUT AS A MATTER OF FACT IT IS A SMALL PAPIER-MACHE MODEL PLACED ON A ROUGH TABLE WITH A SKY-PIECE BEHIND IT

creature could not only threaten a person's life, but also save it.

Only one story of consequence has so far been written around a primate. This was an Italian film where a trained baboon stole a child and carried it to the top of a high smokestack, while far below frantic parents sought to rescue the child from its peril. While on the other hand scores of stories have been written around the various attributes of elephants.

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The greatest interest naturally centers in wild animals when human life is in jeopardy. This is accelerated if a young and beautiful girl is threatened with the strength of a tiger. It has the appeal of weakness pitted against the strength and cunning of the animal world.

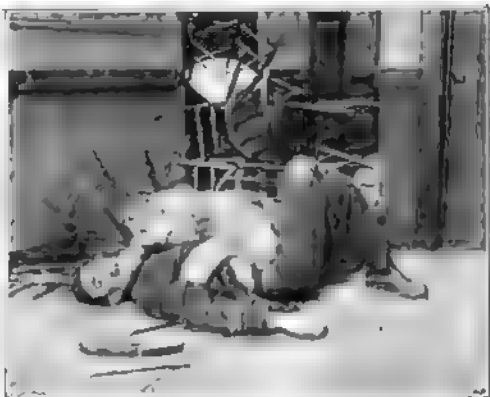
At first animal pictures were made by any company that conceived an idea wherein an animal figured, but later, with the coming of more ambitious films, pictures began to specialize in wild-animal productions. Formerly a bear, a tiger, or a leopard had been hired for the needed number of days from a convenient circus or zoölogical garden, but with the success of animal films picture companies began to gather their own animals, until at least two of them were as well equipped with various animals as were many of the traveling circuses. With the continued specialization in animal films one or two companies gave up all their time to this feature, while the others not so well equipped zoölogically turned their attention to some other phase of picture-taking.

Only pets were used at first, with little or no danger of the actor meeting with a mishap. The curiosity and interest of seeing an animal in a film were depended on to carry the picture. But with the advancement of that end of picture-taking more dangerous feats were exhibited, but these parts were usually taken by the trainer, however meager might be his histrionic ability. With the continued success of animal pictures it was seen that possibly the trainers did not fill every pictorial demand, so the parts came to be taken by actors

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more adept in their profession. As far as the audience could see the actor had no safeguard against a sudden rush of the animal:

Wild-animal pictures are usually made within the confines of an iron stockade, so that if the animal does turn in some other direction than the one planned he will not be able to free himself and terrorize a village. The author recalls a stockade in a California studio where two pictures were being made at the same time within its high iron walls.



AS FAR AS THE AUDIENCE KNOWS THE MAN'S LIFE HANGS ON A NARROW BALANCE, BUT AS A MATTER OF FACT THE LION HAS BEEN SO DOPED THAT ITS EYES ARE ALREADY CLOSED IN SLEEP

While one director was working with a lion another was waiting for him to finish so that he could go on with his own picture. The scene of one picture was laid in the wilds of Colorado in its early days. A miner's hut had been constructed so that the beautiful daughter in her checked gingham apron—so dearly beloved by actresses playing sweet simplicity parts—sitting at her work of shelling peas, should suddenly be confronted by a lion looking through the window. The picture was taken and then the lion was driven down to the other end of the stockade, where a few moments later

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it charged a lone traveler somewhere along the uncertain banks of the Congo.

In the picture where the girl was sitting demurely at her peas, so far as the audience was concerned she was far from human hand, but as a matter of fact she was adequately protected. The cabin consisted of but two walls, but as far as the audience knew it was a mountaineer's hut. On the floor camera lines had been marked off so that it was known to inches just how much of the set would show in the picture. Outside the camera lines stood a row of men armed for the occasion. Some four or five had rifles, while two of them were crack shots from the cowboy camp. Others were carrying firebrands and spears, to be ready in case the lion made a false move. Behind the wall of the cabin, out of sight of the audience but within a few feet of the lion, was the trainer, he alone giving instructions to the creature. For the occasion the lion had been fed and brought to as amiable a mood as the wilderness spirit would allow. The trainer had accustomed the lion to being in the presence of the girl and the scene was rehearsed with the trainer beside the girl until the lion knew what was expected of him. Then stepping behind the wall, the picture was made with the director out of sight. So far as the audience could tell the girl was far from humankind and at the mercy of the king of the jungle, but as a matter of fact some four or five yards away were two or three dead shots adequately armed for the occasion, with others less skilled prepared by spear and firebrand for any emergency that might arise.

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Animals that cannot be trusted are prepared for the picture by being doped so that they go through the scene without ambition to tear and destroy, but as far as the audience can judge they are as wild and formidable as if in their jungle home. But



THE AUTHOR HUNTING WITH THE SULTAN OF JOHORE IN THE LATTER'S EQUATORIAL JUNGLE

Just how this was done is explained at greater—and disillusioning—length on the following page.

even with the best of protection the actors are in danger of their plans miscarrying, and as a result many in the course of a year suffer attacks. The author does not recall a death resulting from the attack of a wild animal while the picture was being taken, although many persons working in animal pictures have had to be taken to the hospital for quick medical attention.

Thrilling as a scene may look when shown on the

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screen, its danger is never so great as it appears from the point of view of the audience. The author recalls a picture wherein the Sultan of Johore was supposed to figure, but from which the Sultan himself was many thousand miles distant. According to the story the Sultan takes his guest on a hunting trip in an automobile, and, waiting in a clearing in the supposed jungle, the beaters bring up a leopard. In the picture herewith reproduced the writer may be seen standing on the running-board of the automobile, rigged out in tropical clothes, elaborately despatching a wounded leopard, while in the background with outstretched arms the beaters make unmistakable the author's aim.

As a matter of fact the realities of the scene are not what an examination of the picture would lead an observer to believe. That the author never felt more secure in his existence than at the moment here pictured may be judged when it is known that the leopard was the zoo's pet and that only by a vigorous jerking of the chain around its neck could the trainer, carefully out of sight, get the creature to open its mouth in protest. The chain was so arranged under the brush that it would not be apparent to the audience, while standing beside the trainer, who had a firm grip on the chain, were three men with firearms and a negro with a spear, all there to lend further security to the author's safety. The natives in the background with their arms outstretched in imagined horror are all colored men living peacefully with their families in Los Angeles. The grass skirts were borrowed for the occasion from the property-room. The elephant is

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Charlie, the studio favorite. Much as the forest looks to be wild and untracked, such is not the case, as may be judged when it is explained that it is merely brush piled against the iron walls of the stockade. Thus the picture was made and some credit came to the writer for being a wild-game hunter of tried courage, when as a matter of fact he was in little more danger than he would be in his more accustomed Subway crush.

IX

THE MECHANICS OF MAKING MILLIONS LAUGH

OF the fourteen million people who go to motion pictures daily in the United States, the greater percentage of them go for the simple purpose of laughing. They do not go to have their emotions raked, but for the purpose of having what is called a good laugh. This burst of risibility is brought to the millions not by finished acting and delicate shading in skilfully managed comedy scenes, but by the broadest of situations—by burlesque. Since so many people are given what they long for, it is well to stop to examine just how these comedy effects are brought about.

Illustrative of the rapidity with which motion pictures have grown and of the means with which this relief is brought to millions, it is interesting to note that the first person to create a film laugh is still living. Fred Ott, now serving as body-guard for Thomas A. Edison, contorted his face in the days of the "Black Maria" into appropriate interpretations of a man suffering all the agonies of one about to sneeze and yet not quite able to relieve himself. Thus was started by Ott an amusement medium that now brings more laughs to the people than all the remaining mediums in the world.

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Now that humor is the predominant note in cinematographic entertainment, its contrast is seen when it is remembered that the first motion pictures offered nothing of the risible. From a car fitted up in imitation of a railway coach, with one end open where the pictures were thrown on a screen, the first passengers took an imaginary journey along a mountain railroad, over passes and through tunnels, their imaginations aided by an off-stage crew manipulating springs and levers which gave the audience the rolling, rocking motion of a train achieving the most dangerous and picturesque part of the passage, accompanied by the clang of bells and by the blowing of whistles as stations and railroad crossings flashed by. Since the picture had been taken by a camera lashed on the pilot of an engine, the audience, with its emotions heightened by the industrious off-stage crew quite willing to ring a bell or blow a whistle at the slightest provocation, had all the sensations of a railroad journey through the Canadian passes without the inconvenience and expense of a return trip. When the steam finally exhausted and the brakes went on with realistic unexpectedness, the passengers wandered into the autumnal sunshine, striving to explain the contrasting presence of Herald Square.

With the passing of scenery from the point of view of a passenger on a pilot, motion pictures began to center around the human element more than around picturesque gorges and smoky tunnels. Pictures of people began to replace railroad passes and debarkations of steamers. From presentations of dances more violent than classical, motion

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pictures passed to the realm of comedy entertainment, but it was believed to hold the attention of an audience that motion was paramount. The directors believed that the secret of motion-picture interest lay in constant and, if possible, uninterrupted physical progression. As a result, the directors who sought to introduce the comedy note depended on the constantly changing scenes and on the concomitant results of an accumulative chase. The more participants and the more obstacles the pursuing individuals encountered, the more humorous the subject was thought to be. A stout gentleman walking along the street steps on the accepted banana-peel just thrown there by a boy whose act is not so much one of carelessness as one of premeditation, and hits the sidewalk with a thump now made realistic by the bass drummer. The stout gentleman looks around for the culprit and, espying him, starts out in pursuit to administer his own system of justice. The boy, more agile, darts away, while the stout gentleman—stout gentlemen being the accepted vehicle of peripatetic humor—follows in pursuit. In his eagerness to reach the boy and carry out his plans by personal contact, the stout gentleman sweeps a bill-poster from his feet as the bill-poster is quietly going about his work on the topmost rung of his posting-ladder. In his fall the bill-poster manages to entangle himself with the paste-bucket, and with the brush dripping with paste he starts out in pursuit—not of the boy—but of the stout gentleman. The stout gentleman, unaware of approaching disaster, encounters a nurse coming down the street



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CHARLIE CHAPLIN AND HIS COMEDY COMPANY WORKING OUT THE BUSINESS OF AN EXTERIOR SCENE
Two cameras minimize film backing and apparatus accidents. The megaphone is used to make the company hear.

HOW MOTION PICTURES ARE MADE

with a baby-carriage and in his flight upsets the incunabular vehicle, while the nurse throws up her hands, after the popular fashion of comedy artists, and joins the chase. The stout gentleman in eager pursuit upsets a butcher-boy, who quickly joins the fast-growing avengers, to be followed in rapid succession by policemen, peddlers, and by such other individuals as suit the comic taste of the director, while the stout gentleman dashes on, unaware of the fast-growing mob. Up hill and down dale, with an increasing number of muddy lakes and manholes, the pursuit continues until the end of the reel is reached, with the scene closing on a general fistic encounter in which the only person to escape is the boy, who leisurely heads in the direction of another fruit-store.

For a time it was believed that cinematographic comedy was limited to such humor as might be inspired by a chase, and in different forms violent-action humor was presented to over-stimulated audiences until finally it was seen that motion pictures were not necessarily restricted in their comic presentations to bodily pursuit. It was conceived that two men might confine themselves to the restrictions of a stage set and yet arouse in an audience pleasant anticipations. Immediately the methods of burlesque comedians were employed, for motion pictures as an interpretative art began as burlesque, as the early humor of the theater began as waggery and clowning and gradually evolved its more subtle form. The recognized means of achieving humor on the burlesque stage was by means of the "slap-stick," by the aid of which one person physically discomfited another. But as the

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cachinnatorily stimulative sound of the blow was gone and as the results of the discomfort were apparent for only a moment, a substitute had to be found wherein the effect of the blow might be apparent to the least imaginative. This was found in the pie. Hurling into a protagonist's face, there was no need for the drummer to stimulate the minds of the audience with an interpretative thump, as the results of the comedian's decision were plainly apparent. The comedy situation wherein the unfortunate individual sought to remove the pie from his face remained longer before the audience than the effect of a kick. The audience had to imagine the effect of a pedal blow, while the hurling of a pie was apparent to the audience in all its humorous detail.

Once found that audiences would laugh at the successful placing of pies, motion-picture actors began to give themselves up to hurling them at one another until no comedy was considered quite complete unless it had at least one pie in it.

While the pie was being made to answer comedy purpose in various disguises, it was found that a character falling into water was also a source of amusement to audiences. The water motif appeared in film after film, month after month, even year after year, until finally it was suspected that audiences were no longer aroused risibly beyond their control by the pushing of one comedian into a river or lake by another. Different expediences were tried, and by a careful checking up of the responses of audiences it was found to a calculable certainty what film situations could be relied on to inspire approval. A list of situations that could be

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depended on for a laugh was in the mind of every director, who employed them at his discretion. The list included:

The hitting of an opponent with a pie.

Falling into water.

A kick; a blow.

A waiter falling down-stairs with a tray of dishes.

Unexpected disaster, such as falling into a man-hole.

Stepping on a lady's train.

Assuming of a woman's clothes.

Fundamentally the psychology was the same as that of the burlesque stage in which the character arousing the comedy sense was struck with a board, a folded paper, or the foot, as best suited the protagonist. Physical discomfort was the comedy's inspiration. The arousing of the laughter lay in the physical uneasiness of one or more of the characters, for human nature is so constituted that it enjoys a passing predicament in another of its kind. The line of demarkation between comedy and tragedy lay in the strength of the blow delivered, or in the height from which the character fell. If the blow was one to cause momentary suffering it aroused laughter, but if it was of such a nature as to cripple or maim the scene passed from the realm of comedy to that of tragedy. A waiter falling down-stairs with a tray of dishes stood high on the list as an assured means of laughter, but the same character falling from a third-story window aroused only anxiety, as the experience of audiences was such as to cause them to know that a fall of two stories might be disastrous.

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Falling into the water stood high in movie humor, and by watching the film's reception a director could calculate to something approaching mathematical certainty as to how many characters might be so immersed without abatement of appreciation.



A POWDER SCENE NEVER FAILS TO AROUSE ANTICIPATORY APPRECIATION
This can always be counted on to make an audience laugh.

The success of such comedy lay in the fact that the full details of the humiliation of the characters were apparent. The audience could see the character in his moment of supremacy, and then could witness his downfall and humiliation with the assurance that he suffered no permanent injury. With the possibility of permanent injury the feeling passed from one of superiority to sympathy.

Misfortune was the motive of all early moving-picture humor. The misfortune might be unexpected or impending, but back of the situation was the element of distress. The hitting of an opponent with a pie was misfortune, but of a remediable nature; the falling down-stairs with a tray of dishes

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was a catastrophe to be paid for in physical suffering and mental humiliation. The more pronounced the element of misfortune the greater its comedy possibilities, it was generally believed. A situation regarded as absolutely certain of inspiring laughter was that of an innocent person going unwittingly about a powder-factory, or taking up his position near explosives and starting to smoke. The element of danger, coupled with that of suspense and anticipation, made the scene such a favorite that few comedies of pretensions went out without this situation's inclusion. So often did the powder situation appear that it took on almost the qualities of a trade-mark. A comedy without it was not considered of quite the best quality and workmanship. The powder situation is still appearing, but it is no longer regarded as quite so histrionic a triumph.

Suspecting that audiences had given expression to about all the manifestations of amusement that could be expected for individuals for whom powder and pies formed such a persistent Nemesis, and for waiters who so constantly met with untoward accidents in the discharge of their duties, motion-picture directors sought to vary the situations wherein the motif was more mental than physical. Instead of depending on a pie or on a tray of dishes to arouse appreciation, the directors began to conceive situations in which there was no exchange of blows or demonstrations of violent physical contact. Soon to become a favorite was the scene wherein a young man of exaggerated haberdashery seeks to make street acquaintance with passing trim figures. Spying from a covert of observation

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a figure that arouses in him desire for further acquaintance, he arranges his boutonniere and, spreading his breast-pocket handkerchief at an alluring angle, starts in pursuit of the retreating figure,



A WAITER STUMBLING WITH A TRAY OF DISHES IS ALWAYS CERTAIN TO BE GREETED WITH LAUGHTER

If he stumbles and falls on a stairway it is even funnier. The more seriously it is taken by the people concerned the more hilariously it is received by the audience.

to have his hopes aroused to a greater degree of anticipation when the lady drops her handkerchief. Picking up the feminine bit of embroidery, he hastens after her and with his hat in his hand makes an elaborate bow of presentation, to have the person in question suddenly turn, revealing herself to be a colored woman of pronounced pigmentation. Although the embarrassment was wholly mental, it was found to be quite within the range of appreciation of the audiences that the picture-producers

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had thought could rise intellectually no higher than a well-placed pie, and, with its success, other scenes making use of the same mental contretemps came to be used. Scenes of this kind wherein there was no confectionery or pedal exchange were received with as much appreciation as were the water and unexpected-disaster situations. In this list of scenes of mental rather than physical discomfort, a wider scope of situations appeared:

One of small stature bent on revenge starts out to find the person who has done him wrong, suddenly to encounter an antagonist of unexpected physical proportions.

Caught in dishabille.

An intoxicated individual mistaking the uses and functions of familiar objects.

The amorous youth who, while caressing a new-found acquaintance, has his attention distracted for the moment while the lady in question slips from his side on the park bench to be replaced by a passing hobo. The young man, knowing nothing of the exchange, returns his arm and, as his fingers encounter the unshaven cheeks, seeks to co-ordinate his previously conceived views with confronting actualities.

With the advent of these scenes where the contretemps was mental rather than physical, it was discovered by directors who had undertaken the presentation of incentives for laughter that film humor could be further subdivided into the humor of anticipation and the humor of surprise. At first the sense of the incongruous was appealed to only

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by the humor of the unexpected—by the sudden hurling of a pie or the quick despatch of a kick—but it was soon seen that a more extended situation resulted if the audience might anticipate the humor, see it gather, and then enjoy its dénouement. Such a situation was one where the person meaning to bring sudden disaster to another was the object of the gathering cloud all unknown and unsuspected by himself. A guest coming into a restaurant seats himself at a table, to become involved in an altercation with the waiter. The waiter, in revenge, with an outward show of accident, upsets on him the soup. Determined to apply a swift and personal code of juridical administration, the man arises and with a pie in hand waits behind a swinging door. While the man is waiting the proprietor approaches silently from behind, with a mop-handle, to clear his store of such undesirable patronage. The humor of the situation rises from the fact that the man with the pie knows nothing of the danger so soon to befall him. He is bent on avenging himself, while unknown to him a worse catastrophe is piling up for his inclusion. The situation is enjoyed by the audience because the audience knows more than the character on whose head destruction is about to descend. It is the satisfaction of superior knowledge. If a maniac with a club should approach from behind, the scene would pass immediately from the realm of humor to that of tragedy.

Once this double-motived situation was discovered by motion-picture directors, it was employed in a hundred different guises. As such it has come to be the favorite appeal of Charles Chaplin. Tak-

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ing the part of an escaped convict, he was being pursued by two police guards whom he thought he had foiled. Climbing to the top of a craggy eminence and looking over, he observed two uniforms which he thought to be his pursuers. Elated at his success in outwitting his captors, he began rolling boulders down on them, lying down on the cliff to revel in the wild leaps that the men found necessary to escape the falling stones. The double motive lay in the fact that only one of the pursuers was below; the other was silently slipping up as the protagonist lay on the ground calculating the speed and despatch of his rocks. The nearer the guard drew the more the erstwhile prisoner enjoyed the plight of the man below, the more the audience laughed of their superior knowledge. Their appreciation was heightened by the unexpected way by which the convict outwitted his pursuers. Walking over the prostrate form, the guard bent over to lay hands on him, when the recalcitrant adventurer sent the guard over his head and over the cliff by a sudden and well-placed kick.

However, all the humor of Charles Chaplin is not from dual-motived situations, nor from the unexpected blow, nor from the exaggerated kick. An evening's entertainment cannot be carried by two humorous appeals, however much they may be varied. To this is added, in his own case as well as that of lesser farceurs, the situation by which he gets himself into a passing predicament—such as the need of the moment making it necessary for him to put his plate of ice-cream into his pocket, with the perplexity that arises from the resultant

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melting. The concomitant disaster that this sets in motion, with the final extraction of himself, is the source of its humorous appeal. Always, it was found, this was responded to quickly by an audience if the feeling of superiority was catered to, not only in situations where the pending disaster was plainly before them, but also where the character did things that no one in full possession of his mental faculties would do. A stout gentleman (exaggerated cellular tissue always having a humorous appeal by reason of its patently visible handicap) had just been rescued by Chaplin and, placing the stout gentleman on a stretcher, he started dragging him across the dock to a waiting vehicle; but with one end of the stretcher elevated the stout gentleman, at the first steps of his rescuer, slipped back into the engulfing water. Arriving at the automobile, the situation was lent an added comedy value by the rescuer's surprise at not finding the stout gentleman on the stretcher; the situation was still further heightened by the hero turning the stretcher over to discover the stout gentleman's whereabouts. As the space under the stretcher was hardly sufficient more than to secrete a doll, let alone a man of pronounced physical proportions, the audience gave expression to its appreciation. The humor lay in the feeling of superiority aroused in the audience; not a member who thus voiced his appreciation but felt that, similarly situated, he would have known better than to look under a low-lying stretcher for a man who could scarce be concealed under a high-standing bed.

Gradually the comedy of the films passed from

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the isolated incident to the comedy of situation. In the early burlesques no plot was needed for the presentation of film comedy; a director considered all that was necessary was a cast representing diversely a policeman, a banker, a bill-poster, a mendicant of the approved humorous-weekly type, and a pretty girl. With these—with the possibilities accelerated by stage properties in the form of a step-ladder, a garden hose, or a bucket of paste—he started, but without any clear progression of plot or sequence of incident in mind, depending solely on the inspiration of the moment for his comedy. The banker—such a favorite of the filmmakers—is taking his way down the street, while a bill-poster on top of the ladder busies himself with his brush, to spatter the gentleman of commerce as he passes beneath. The gentleman of commerce stops to expostulate with the bill-poster and, as the altercation grows more violent, the banker succeeds in stepping in the paste-bucket and in being amorously mistaken by the pretty girl for her long-lost rich uncle. Incidents of surprise, anticipation, and physical humiliation are piled on one another without logical sequence, each depending on its isolated situation for its appeal until something approximating an end is reached or the needed footage is exposed, when the film is titled and sent out as a comedy. From this method of unrelated incident the production of motion-picture humor has steadily inclined to the humor of progressive situation. Just as stage humor rose from burlesque for the groundlings so cinematographic humor has risen to an appreciation of

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a more advanced intellect, until now the humor of the situation may be evidenced by such small physical display as a man pulling at his collar or by the nervous twitching of an eyelid. Directors, slow to believe in the subtlety with which humor could be conveyed, began to appreciate that it was not necessary to resort to pie to make a situation unmistakable. With this discovery directors began to make use of a progressive series of events founded on clash of will and opposition in character. For such, a pie or a step-ladder was not necessary for their adequate presentation. Slowly logic began to replace the pie. But for the presentation of such comedy a higher grade of intelligence was needed among the actors, and as a result the actors with a comedy sense were recruited from the legitimate stage, with a sudden rush for stars.

With the advent of motion pictures into the realm of high comedy disappointment was felt, for the reason that only one medium of expression was open to the cinema—the physical. Fine shadings of tone and the carrying of a point by the rise or fall of a word were no longer possible. It was a canvas of one color. No longer could a scene be made delectable with the characters sitting it through at a tea-table with their mental boldnesses and shynesses made apparent by inflections. Working in one medium the characters must mirror themselves by elaborated physical actions. As a result the characters had constantly to keep on the move, substituting pronounced gesture for shaded inflection. Working in one medium, depending wholly on gesture, few there were who could carry a

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comedy situation with the suppression necessary to keep it in key with the tenser situations of the play. As a result salaries began to mount up for those who could play high comedy, producing players of the eminence of Mary Pickford, Marguerite Clark, and Douglas Fairbanks. In character, sentimental, and heroic parts there were many players who could interpret such rôles with equal skill, but in the presentation of humor they had not the same gift. Humor, a seasoning rather than a sauce, appealed most strongly when correlated with juxtaposed scenes of pathos and sentiment, and these film players, able to so correlate it, at once commanded extravagant salaries. Showing no greater histrionic facility than many of their fellow-players, they were able to command such disproportionate salaries by reason of their more delicate comedy feeling.

High comedy finds its best *metier* on the stage. The plays of Shaw and Wilde would find little favor with film audiences, as the processes are mental rather than physical. Film audiences would have little interest in three people adventuring for half an hour at a tea-table.

But in the realm of low comedy motion pictures are supreme. Burlesque humor, always dependent on properties, can avail itself of automobiles, swimming-pools, street-cars, skyscrapers, and other physical paraphernalia denied the legitimate stage. With these and the effects that may be secured by multiple exposure, double printing, and trick photography, the broad humorous possibilities are unlimited. By dexterous manipulation of the photo-

MECHANICS OF MAKING MILLIONS LAUGH

graphic diaphragm, dissolving-shutter, and graduated screen, characters may be made to come and go and to assume any extravagant proportion that a director sees fit until almost any actor, however limited his comedy sense, may manage to bring



GIRLS IN GROTESQUE MAKE-UP ARE NOT SUCCESSFUL AS COMEDIENNES

Once they followed the men in making their faces hideous, but now they are put in comedy costume, but the attractiveness of their faces is left untouched.

to an audience in some degree a stimulation not altogether unpleasant. As a result it is not surprising to see the film ranks filled with players whose chief claim to being comedians is their make-up.

For this reason the greatest film comedians are men. There are no film comediennes worthy of the name. The part is being assayed by a meager half-dozen with success in no way commensurate

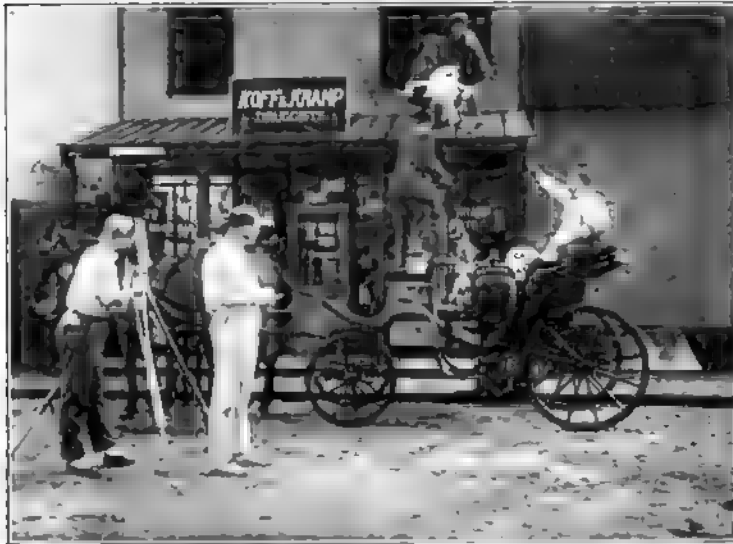
HOW MOTION PICTURES ARE MADE

with that of the men. There never will be any worthy cinema women comedians except in the realm of high comedy, for the reason that motion-picture comedy finds its chiefest appeal in the realm of low comedy. Women are not successful as low comedians, for the reason that to attain their purpose they must lower their social status in the eyes of the audience. The position of the player in low comedy is below that of the audience; an actress cannot play low comedy in an evening gown. She must suffer physical humiliation by falling downstairs, rolling in the mud, or by being the target of the ever-popular kitchen products. This she cannot do and retain the respect with which woman is generally accorded even by the most transplanted of audiences. An audience does not want to see a woman the successful mark of a pie; it wants her to keep some semblance of dignity. Histrionically, she may throw the pie, but she must not be made its recipient. She may be caught with her hair in curl-papers, but she must not be hit with a mop. If her embarrassment is more than mental, the sympathy of the audience is aroused instead of its sense of the ludicrous.

In one of the city lakes in Los Angeles a girl trying to emulate the methods and materials of Charles Chaplin was thrown for comedy purposes into the water. The lake was drained, a rope flung her, and, with the camera recording her struggles, she was dragged in with the mud covering her hands and face and smearing her clothes. Judged from the standards of male comedians the situation was one to rise to dizzy heights of mirth, but when it

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was shown to audiences it was received without a sign of pleasant stimulation. But a few moments later when the man playing opposite her was reeled in from the same coign of vantage he was received



FATTY ARBUCKLE DIRECTING HIS OWN COMEDY SCENE IN FRONT OF A
PROPERTY DRUG-STORE

with appreciation. The woman going through the same acrobatics was received pityingly, while the man's reception was enthusiastic.

With the entrance of the first women comedians into celluloid comedy they quite naturally followed the lead of the established male comedians by assuming grotesque garb and smearing their faces and playing a rôle that depended more on contortion than on control. But their reception never passed beyond that of curiosity. Unable to understand why male comedians should be received so en-

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thusiastically and women assuming their make-up so impersonally, motion-picture directors put forward one female comedian after another, hoping at last to be rewarded by a histrionic find, but without success. No waitress falling down-stairs with the accepted tray aroused half the enthusiasm of a similar accident with the same dishes in the hands of a man. Still cognizant of the feminine appeal and experimenting to find the proper feminine presentation, girls were introduced into comedy costumes by Mack Sennett, but were not required to depend for their humor on physical and facial contortion. Beauty rather than severity of feature was the first consideration, with the comedy arising from the temporarily embarrassing situation in which the female players found themselves. The costumes might be unconventional, but the interpretative actions were not forced beyond the standards of accepted feminine dignity. The new players were received with more enthusiasm than yet accorded feminine burlesquers. The cue is now being followed, so that the tendency to-day is for the female players in burlesque to have beauty parts, with the acrobatics left to the men.

Danger is the chief element of burlesque humor. When this is coupled with feats which the audience cannot understand its interest is doubled. It then has two motives—comedy and mystery. Nothing delights an audience more than to see something humorous that it does not understand—something contrary to the accepted course of events. For this reason automobiles are made to run backward in circles around lamp-posts—even made to climb

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these same structures—while the audience manifests its appreciation in shouts of glee. Here the amusement comes from the scene itself. The scene may have no bearing on what has gone before or what will follow, but if it is humorous and mystifying it justifies itself so far as the audience is concerned. No attempt is made at character delineation. The scene depends on its threat of danger and on the mystery which it arouses in the audience as to how such a thing could be accomplished. More often than any other is the question asked of persons capable of



COMEDY EFFECTS ARE ALWAYS TO BE DERIVED WHEN ACTORS PLACE LARGE AND POWERFUL CREATURES IN RIDICULOUS SITUATIONS. AUDIENCES LIKE TO SEE POWER DEFIED

Here the comedian swinging on the ostrich's tale is supported by an invisible wire from an overhead trusswork which, fastened on an auto, moves along with a speed equal to that of the bird.

answering them how certain feats are accomplished in burlesque films. The audience has been moved and mystified and it is ready to go away satisfied, eager only to know when the next burlesque will make its appearance.

From the colored Sunday supplement the children of Foxy Grandpa have been moved to the film studios. A child defying dignity and authority

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arouses response in an audience and if the child turns the hose on a gentleman with a silk hat the film is pretty sure to be a success. If Jane and Katherine Lee are mistreated in one scene and in the next turn a goat loose on Grandpa weeding in a flower-garden the picture is practically certain of being a best seller.

Nor is appreciation of humor confined to simple minds, for many in its audience are of the purely intellectual type who at the appearance of the goat and the silk hat surrender themselves to the ridiculous and laugh unabashed. Just as certain Senators are said to find relaxation in the adventures of King Brady and similar sleuths, so individuals of presupposed intellectual attainments abandon themselves to the delights of burlesque. Personally, the interest of the author in burlesque is the wonder that so many people sit it out. To him there is more enjoyment in a gesture by Charles Chaplin than in the wildest adventure contortion of his imitators. Chaplin is guided by the same motives and cross-motives of an average human being, but in other burlesquers the characters' action is without motive and as a result stirs no response in our bosom.

Animals entering into a picture combined with the element of danger are certain of risible response on part of the audience. A comedy studio is no longer fully equipped without its attendant zoo. The appeal is enhanced if the action is such that the audience does not understand it. In the picture of the janitor seeking revenge by biting a joint of the lion's tail the appreciation is heightened by the

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fact that the audience is held breathless by the danger the humble workman is in and by the fact that in its experience it does not know how a man can approach the animal free from bars and cages and thus attack him and live to tell the story.

As a matter of fact the animals used in such pictures are pets of tested gentleness, overfed and doped for the occasion, with trainers and guards just outside the camera lines, making the janitor's danger not so imminent as it appears. By means of outside and inside masks and double exposure



SUCH A SCENE MAY BE PLAYED EITHER FOR DRAMA
OR BURLESQUE

With an emotional actress the scene would be drama; with the janitor biting the creature's tail it is comedy. The lion is a pet and both animal and man are on a moving platform which keeps the animal from turning.

animals may be made to appear in places and in company with characters when as a matter of fact the characters are far away. One picture in particular showed a lion riding in the back seat of an automobile with a perturbed comedian beside him, when as a matter of fact the actor had been taken at one time and the lion at another, but to the audience the two were sitting side by side in the narrow embrace of a Ford seat.

More and more people seeking surcease from life's demanding rounds will go to the motion-

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picture theater, and more and more will there be a demand for films of an openly comic nature. As a result, however far character and suppressed acting may go in the more leisurely films, there will be a constant call for burlesque and a continued appearance of pie and powder and supposedly enraged lions.

X

GROWING PLANTS AND MICROSCOPIC SUBJECTS

ALTHOUGH trick films were diverting, it was soon seen that there were those whose interests were not circumscribed by the exploits of a bibulous husband forced to take refuge on the moon by the exigencies of domestic life. It was seen that there were those who were just as much interested in the unfolding of a flower as in a chase with its accumulative disaster, and so pictures depending for their interest on information rather than on imagination were soon being offered to the public.

Audiences accustomed to nothing more mentally demanding than the disasters befalling a bill-poster who chanced to be in the path of a crowd seeking revenge on a fat man making every endeavor to escape, turned with welcome relief to films that based their appeal on something other than the imaginations of alleged comedy-writers. For such the film showing the planting and the blooming of a flower opened up a new world. A gardener was shown preparing the bed, followed by a near view of his hand planting the bulb and pressing the earth over it. Slowly a clod began to stir and out from under it, as one watched, came a tiny sprout. Before one's eyes it began to grow, pushing up, forming

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a stalk, branching, throwing out a bud, and finally unfolding into a flower. The life process of a lily was thus shown in three minutes. Interest as to how it was done was aroused.

The film of the growing lily was made by means of interrupted exposure and continuous projection. A scene was taken outdoors of the gardener going down a path carrying his water-pot. Then his hand was shown planting the bulb and pressing down the earth. The following scenes were taken indoors, but as they showed only a small area—usually nothing more than the lily itself—on a black background the audience thought that it was still witnessing the growth of the bulb planted in the open garden. However, the actual growth and development of the plant was carried on in a studio specially arranged for the process. The roots of the lily were heated by electric wires to force the growth of the plant. The camera was brought up close to the sprout, with a black curtain hanging behind so that the plant would stand out in strong relief. By clockwork the camera was operated so as to expose one frame every twenty minutes night and day during the growth of the plant.

Not only was the unfolding of the lily shown, with the flower slowly opening, but the process of reproduction was also depicted. As much of this process is far down in the plant itself, a combination of exterior views and diagrams was used. Thus the pollen was shown to lodge on the stigmatic part of the pistil, from which it sent out a tube through which the male generative cell passed to the ovule, where it fused with the egg cell.

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Processes that the eye could not see, or so far apart that they had little appeal, now became of interest by reason of their continuous showing. The growth of a plant in the flower-garden that held no interest except with the blossoming of its flower now had the suspense of a plot unfolding. With the introduction of the insects that preyed on the flower, the plant's struggles became as interesting as those of a screen star.

By an elaboration of this process a new world was opened up to those interested in something other than heroism and villainy.

Now, however, the method pursued in making flower subjects is to let the plant grow naturally instead of forcing it by electrical heating. The plant is taken to a studio equipped for nature studies which has a top that can be thrown open or closed at will so that the direct sunlight may reach the plant. A camera rigged up beside the plant shows the flower's hourly progress. The camera is operated mechanically so that it demands little attention from the photographer. By means of either a glass or an open skylight the sunlight alone is used to stimulate the plant. The sun shines directly on the plant until the

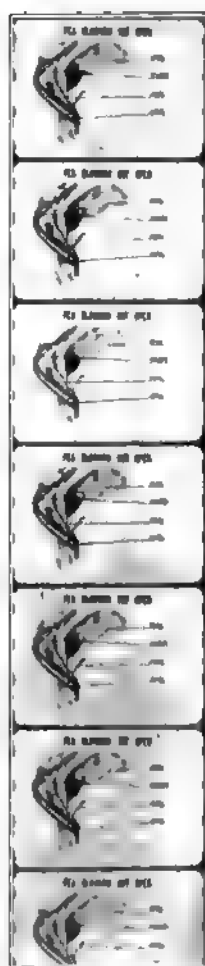


DIAGRAM USED IN CONNECTION WITH MOTION PICTURES TO SHOW THE FERTILIZATION OF A PEA

HOW MOTION PICTURES ARE MADE

moment of exposure, when a curtain is drawn across the skylight, an electric light is turned on, and the needed exposure made. This is kept up at stated intervals during the weeks or months required by the plant to reach maturity. The studio is darkened so that the photographic light will be of the same intensity both day and night. Even though the direct sunlight might give a sharper picture during the daylight hours, the electricity is used so that the completed film will show no fluctuation in light values. The film that may require three months in the making is shown so rapidly on the theater screen that the plant seems to grow and the flower to unfold before the very eyes of the audience.

In this way a film of educational and scientific interest was made by George E. Stone, of Berkeley, California, which brought together in graphic form well-known life processes which up to that time had never before been associated closely enough to show how nature keeps at the ever-necessary process of reproducing itself. Not only did the film show how a flower grows and reproduces itself, but the process of reproduction was carried through bacterial, lepidopteral, amphibian, and mammalian life.

A frog was shown laying eggs in shallow water, to be fertilized immediately by spermatozoa from the male. The spermatozoa are seen to make their way by means of flagella. Propelling their way through the water, they meet the ovum mass, which they enter and fertilize. The heat of the water makes the eggs grow until from their elongated

GROWING PLANTS; MICROSCOPIC SUBJECTS

forms small legs begin to appear. Gills form and from the protecting jelly the tadpole slips out. Gradually it gains its second set of legs, while its gills are replaced by lungs—the whole life process of the frog being made clear in two minutes.

The filming of the lepidopteral part of the film was accompanied by more anxiety than a casual inspection of the film would lead one to believe. Mr. Stone wished to show the life process of a butterfly from the eggs through the caterpillar stage to the larval period, and then the final freeing of itself from its chrysalis and the spreading of its wings in flight. A camera was set up and exposures made of a number of butterfly eggs to show their size and number. The eggs were watched while the heat advanced the process within until one was observed with a shell eaten to such thinness that the process within was visible. Observation was restricted to this one subject and the egg enlarged till it filled the photographic field. Motion pictures were made at regular intervals of the weakening of the shell wall and its final breaking with the release of the young caterpillar, much after the fashion of the young chick. As the months went by a careful watch was kept over the chrysalis, so that the process of the butterfly freeing itself from its enveloping skin might be shown. The skin, dry and dull at first, slowly began to glow with the colors of the developing butterfly beneath. To make certain of being in readiness at the moment of the final freeing, Mr. Stone carried the chrysalis in a box in his pocket for two weeks.

As the days went by and as the color slowly began

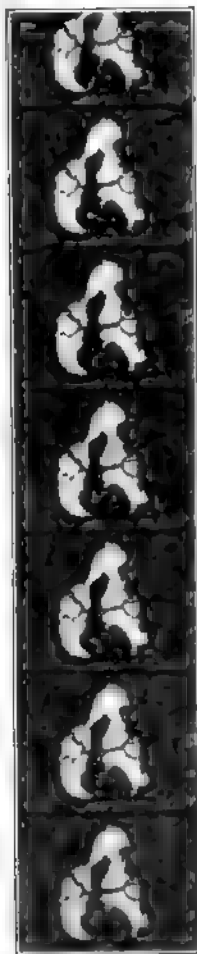
HOW MOTION PICTURES ARE MADE

to grow brighter, Stone knew that the hour of the final struggle was approaching. While he was sitting in his studio one day, with the box on a table near at hand, he heard a faint crack. The chrysalis had split! The hour that had been awaited for a year and a half had come. It was to mark the completion of the butterfly part of the film. Quickly the chrysalis was placed under the camera that had been awaiting it, while Stone took his position at the crank. But at this critical moment, while the butterfly was struggling to free itself from the skin that had so long held it prisoner, the arc went out. In attempting to regulate the carbons, and in the excitement of the moment at this unexpected culmination of months of preparation, the assistant forced the carbons so violently together that they snapped off. Before other carbons could be inserted and adjusted the butterfly had emerged. The preparation of a year and a half had gone for naught.

Motion pictures of the hatching of an egg were also shown in the cycle to illustrate the different phases of re-creation. The placing of a setting of eggs under a hen was seen, and then the camera was directed on one egg and its gradual interior change was depicted during the twenty-one days until the chick was able to free itself from the incasing shell. However, a more novel method could have been pursued. An opening could have been made in the egg-shell and a piece of isinglass cemented over and the incubation beneath photographed, but by means of transmitted and reflected light and placing the growth in open containers this was not necessary. Eighteen hours after the

GROWING PLANTS; MICROSCOPIC SUBJECTS

heat was applied, the egg had divided and so shaped itself that a faint change could be seen, but for popular presentation this was not marked enough, so it was not recorded on the film. The first exposure for the finished film was made twenty-four hours after the application of heat and pictures made at intervals up to the ninety-sixth hour, but at that time the exposures were discontinued for the reason that the pictures were too unsightly for showing to an unselected audience. The embryo had then sunk into the yolk and had become covered with vasculated vessels unpleasant to an audience not particularly interested in the scientific aspects of the picture. Minute and detailed study was made of the changing process by opening one of the eggs in the setting and making a picture of the embryo direct. The embryo was merely a filament of skin which could be sucked up with a pipette and placed wherever desired. This embryo could be kept alive for as much as sixteen hours without precautions against decay more than keeping it in a solution of common salt. Life would seem to be extinct, but on heating the solution the heart would start to beat again. With the decay of the embryo it would be replaced



THE FIRST CIRCULATION OF BLOOD THROUGH A CHICK EMBRYO

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by another from the setting at a more advanced stage, and thus the process continued until the twenty-one days were up and then a picture made of the chick pecking its way to freedom. So successful was the process that the chick could be seen breathing long before it was freed of its shell. Air was possible by the porous nature of the shell. Thus the life process was shown from the placing of the eggs under the mother until the chicken was able to stand. The process that required three weeks in the filming was presented in a trifle more than three minutes.

Wishing to know how birds protect their young, Mr. Stone availed himself of hatching birds in his own orchard. A platform sufficient in height to put the camera on a level with the nest was constructed near the tree, but it was found that the nest was so sheltered that even after the birds had become accustomed to the click of the camera there was not sufficient light to bring out the birds on the film. Intervening leaves and branches were cut away, but still the light was inadequate. At last a twenty-inch reflecting mirror was brought and placed on the stand alongside of the camera so that light could be reflected on the nest and on the birds at will. This in turn startled the birds so that they had to be made accustomed to both the click of the camera and to the strong light. When the birds had gained confidence enough to bring food for the young while the strange visitors were only a few feet away, it was found that the wind swaying the branch containing the nest made the picture unsteady, so the limb had to be wired

GROWING PLANTS; MICROSCOPIC SUBJECTS

and an opportune time awaited for the taking of the picture. At last this was achieved with the parents going about their duties seemingly as unconcerned as if in the heart of a tropical forest.

Encouraged by the reception of popular informative films, steps were taken to

show micro-

scopic subjects.

But early effort

soon showed

that the photo-

grapher faced

an entirely dif-

ferent proposi-

tion. Satisfac-

tory still pict-

ures had been

taken of bac-

teria and mi-

croscopic

forms, so it

was thought

that the record-

ing of them in

motion pict-

ures would be a simple matter, but when the work

was undertaken unexpected difficulties arose. The

difficulties lay in the fact that for the purpose of still

photography the organism was killed and the tissue

dyed with substances which colored the various

structures unequally. These dyes, having an affin-

ity for different tissues, brought about graduations



CAMERA EQUIPPED WITH TELEPHOTO LENS AND MIRROR FOR DOING OUTDOOR NATURE STUDIES

The mirror is here being used to reflect light into a tree for a bird picture.

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in light and shade that made photographing the organisms merely one of magnification. The photographer was thus able to make use of a widely varying contrast of detail. The photographer had but to choose from his stock of color filters those which served to accent the various colors of his subjects, and thus he was enabled to register on his negative a satisfying contrast in detail. In addition he could carve his subject and secure any part or position he wished. With all ready for the actual exposure of the plate he could consume any amount of time that he wished; the plate could be exposed a hundredth part of a second or several hours, as desired.

But the bacteriological microcinematographer was not so fortunate; his primary object was to show the organism normal and alive. The organism could not be sliced and few dyes could be found that did not result in death to the microscopic subject. Worst of all he had little opportunity to vary his rate of exposure. In most motion-picture cameras, when operated at the rate of sixteen pictures to the second, the rate of exposure is one forty-fifth of a second. Even with the most versatile of cameras the rate of exposure could not be varied to more than one thirty-second part of a second. The rate of exposure is less than one-sixteenth part of a second for the reason that part of the time is consumed in moving from frame to frame. As a result the motion-picture microscopist can never hope to achieve as great an amount of detail and as good work as the worker in the older form of photography.

GROWING PLANTS; MICROSCOPIC SUBJECTS

The hope of the motion-picture microscopist lay in the possibility of flooding the organism with light of such an intensity as to bring out every detail for the limited time he had for exposure of his film, but it was found that the light killed the organism; so the microcinematoscopist had to go about finding ways and means of using a strong light without sacrificing his subject.

The first work of this nature was carried on by Doctor Comandon, of Paris, who achieved pictures of the highest magnification yet reached by motion-picture photographers. The intense light that he employed in illuminating his photographic field he found killed the subjects of his research; he saw that to attain satisfactory results he would have to devise some way of shutting the light from the subject except while it was being exposed. In time he worked out a principle by which a steel shutter was rotated between the light source and the microscope in synchrony with the camera. Thus no light reached the photographic subject except while it was being exposed on the film. He was able to achieve unusual results, but from the elaborate equipment he employed the idea became general that bacteriological work was almost impossible by reason of the heat killing the organisms under observation. As a result further photographic effort on the part of other workers was delayed until the work was taken up in this country, when it was discovered that heat was not as damaging a factor as was believed. Comandon, it has been found by American experimenters, used an excessive amount of current and to offset this he employed a water

HOW MOTION PICTURES ARE MADE

cell between his subject and the arc. He kept the water circulating in the cell so as to maintain a low temperature without being aware that as far as transmission of heat rays is concerned there is little difference between hot and cold water. The energy transmission of a hot-water cell is 18.4 per cent., while that of cold water is 19.2 per cent., making a difference of only 1.2 per cent. In addition he kept the water moving to prevent its reaching the boiling-point, believing that if the water in the cell came to the boiling-point bubbles would arise, which would obstruct the passage of light. He did not know that the air could be boiled out of the water before putting it in the cell, nor did he know that a piece of charcoal floated on the surface would prevent bubbling.

However, Comandon must be credited with producing some unusual pictures of high magnification. One of the films that he finished showed leucocytes in the blood. The film in question has never been seen by the author, but it is said to show in a manner probably more entertaining than scientific the conflict in the blood on the introduction of a foreign element. The introduction of the foreign element among the leucocytes takes on the characteristics of a battle and by means of the film the process of agglutination may be followed. A parasite is introduced into the plasma of the blood. A white cell acting as a policeman promptly approaches the intruder and seizes it in a sticky hold that the intruder cannot break. Back and forth they struggle, the policeman throwing out more and more of the sticky substance until the parasite

GROWING PLANTS; MICROSCOPIC SUBJECTS

begins to weaken. The policeman clings to him until all signs of activity cease, when the policeman celebrates his victory by swallowing the enemy.

Magnification need not be extreme, contrary to popular opinion, for with a magnification of one hundred diameters objects are brought out in detail that are scarcely visible to the human eye, such as the point of a needle. A magnification of one thousand diameters brings out organisms that are wholly invisible to the unaided eye. Higher magnifications are rarely attempted. Even with an enlargement of a thousand diameters, coupled with the increase in size given by throwing the object on an ordinary motion-picture screen, a parasite that is invisible to the eye under ordinary conditions takes on, when it is projected, a size and ferociousness that are dismaying. A trypanosome of sleeping sickness, when it is magnified one thousand times and then projected on a ten-by-twelve screen, looks like a prehistoric dinosaur bent on ravage and destruction.

In preparing a microscopic subject a trouble is experienced that is almost as great as that of heat. It is the shortness of focus of all microscopic objectives. In comparison with a camera lens, a microscopic objective has no depth of focus. It is an optical limitation and not one of construction. This necessitates the confining of the subject in such a cramped space to keep it from getting out of focus that it has little or no opportunity to move. Hampered by this lack of depth of focus, if the organism moves the slightest bit it is out of photographic range. If the organism is held fast it is so

HOW MOTION PICTURES ARE MADE

cramped that it cannot move, and as a result the pictures are defeated in their purpose.

In the film, "How Life Begins," the simplest process of reproduction shown is that of the paramecium. The paramecium is the common form which may be found in any pool of stagnant water. How to get the organism in focus and yet to give it freedom of movement was the question. For two weeks experiments were made to find ways and means of photographing the animal in its native state. At last a solution was hit upon by placing the animalcule in a cell composed of a circle of oiled Japan tissue-paper, something of the shape of a pill-box, but shallow of depth. This was sealed with a glass cover. The box was deep enough to allow the paramecium to swim freely and yet shallow enough to keep it in focus. The subject was moved up and down or laterally, as needed, by micrometer screws which permitted fine adjustment. The arc-light was controlled by clockwork, while a foot-switch set the camera in operation or turned it off at will. Even with these arrangements two weeks were consumed in making a study of the reproductive process of this fresh-water animal.

The advantage of the film which showed how different forms of plant and animal life came into existence was not so much the individual studies as the juxtaposition and the gradual unfolding of the life processes. The likeness of the manner of reproduction of a frog to that of a flower bearing pollen is not impressive until the two processes take place before one's eyes in rapid succession. The success of the film lay in the fact that the life

GROWING PLANTS; MICROSCOPIC SUBJECTS

processes could be seen as a whole and in correlated sequence. Professors who were familiar with the individual processes illustrative of the various phenomena had the facts presented as a single process in a way that aroused even in them a new appreciation of the mysterious force known as life. The film soon found its way into schools and colleges and is now being used by them to advance biological appreciation.

XI

MOTION PICTURES OF THE WAR

WITH the advance of interest of motion pictures it was found that audiences were willing to see pictured before them something other than the sufferings of a misunderstood wife or the mishaps of an ambitious comedian. A few timorous ventures were made that showed that audiences were as willing to witness scenes of current actualities as the interpretations of more or less satisfactory actors. A few scenes of news events of general interest more than justified expectations, with the result that arrangements were made to issue at stated intervals reels devoted only to news happenings. Out of these few venturesome scenes the present means of taking and distributing news pictures was built up.

Pictures in film form depicting the news of the day are now welcomed with as much enthusiasm as are the dramatic releases. With the growing interest in news films, plans were matured to widen the scope of the news departments so that all the happenings depicted might not be from New York City. The extending of a news service with the expense involved in having camera men wherever news might be expected made it impossible to com-

MOTION PICTURES OF THE WAR

pete in price with the dramatic film until a solution was forthcoming whereby it was not necessary for a film company to have in waiting an operator at points where news might be expected to materialize.

The extension of the service was brought about by commissioning men with cameras to act as news



THE NEWS CAMERA ON SHIPBOARD
Doctor Cook is being photographed.

agents in certain districts for the producing company. Each operator was to furnish his own camera, to expose the film at his own judgment, and to submit the negative on approval. By this method the news pictures are now gathered; by this means pictures are forthcoming not only from every city and district in the United States, but from all over the world.

The local studio photographer may equip himself with a motion-picture camera and on submission of examples of his work be made the represen-

HOW MOTION PICTURES ARE MADE

tative of a news-gathering agency for that district. The exposing of the negative, when some event of unusual interest happens in his territory, is a matter of his own judgment. Without waiting to develop the negative he ships it by express to the film company, which develops it and by examination of the negative determines whether or not it wishes to release the film through its exchanges. If the scene is one of interest it is printed and put into the news release.

The local representative is asked to send only negatives so that the film company may not only save the time it would take to develop the film in a studio unprepared for motion-picture-film development, but also to assure itself that no rival company will have a similar scene. The local representative on being chosen by the film company to represent it fills out a blank wherein is given the make of his camera; whether his frame line registers on, between, above, or below the marginal perforations; his telegraph, day, and night address, with his railroad connections. On complying with the regulations of the film company he is given a credential card bearing a number and photo of himself to be used as a means of identification and to exclude impostors whose only ambition is to advance their own ends.

On shipment of the film the photographer makes out a title and a despatching-sheet which shows the light conditions, whether or not it was against the light, whether it was night or cloudy, with a list of the prominent people in the scenes and whether or not rival camera men were present.

MOTION PICTURES OF THE WAR

On acceptance of the film compensation is made at a rate varying from seventy cents to a dollar a foot, depending on the exclusiveness of the film, its national interest, and its photographic clearness. The negative costs the photographer four cents a foot, so that the difference is representative of his profits. But the check may not always be gauged by the footage submitted, for he may submit one hundred feet of an event that seems to him to be nationally important, but which the film company may judge to be worthy of only forty feet, exclusive of subtitles.

From a few haphazard scenes easily accessible to the film company, news-gathering by motion-picture cameras has grown until it is now a skilled and elaborate organization comparable to a large daily newspaper. So often were motion-picture photographers called upon to take their positions on Brooklyn Bridge to secure views of vessels and battle-ships passing beneath, that finally a railing just outside the cable lines was constructed for photographic work. In events of national importance elaborate preparations are made in advance for their filming. At the second inaugural of President Wilson a platform was erected along the line of march for the use of motion-picture photographers. Across from it was the Capitol building so that the passing procession would have a patriotic background. The photographers were required to take their positions on the platform early in the morning, with an examination of their cameras by members of the Secret Service, whereupon the photographers were locked in and required to re-

HOW MOTION PICTURES ARE MADE

main until after the passing of the procession. In this way all chance of anarchistically minded individuals being near the line of march was eliminated. As soon as the parade had passed the operators were released and allowed to rush their negatives to their respective companies. In this way scenes from the inaugural procession were shown in Washington the same evening.

Although not as quick disseminators of news as the dailies, motion-picture companies work with a speed not appreciated by the casual observer. With the explosion of the Seventh Avenue Subway near the Pennsylvania Station in New York, photographers were rushed to the scene by Jack Cohn, in charge of the news department of a film company, a few minutes after the announcement of the explosion, which occurred at half past eight in the morning. At twelve the pictures were being shown on Broadway. This he was able to accomplish more by fortuitous circumstances than by plan. When the news of the explosion came over the police wire the photographers were in automobiles ready to be sent out on the day's assignments. The chauffeurs were instructed to drive to the scene of the disaster, beating in their promptness the Fire Department. Cameras from different points of observation were held on the scenes of wreckage and rescue, the negatives rushed to the developing-room, and the printing given preference over the day's run of dramatic subjects, establishing a record for promptness.

With the opening of hostilities in Spain in 1898, interest in news pictures was becoming more than

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local, so with the American troops in Cuba a motion-picture operator was despatched to bring back in animated form the advances of our soldiers. After weeks of waiting, a daylight charge was made and the operator triumphantly turned his camera on the scene to record it for others not so fortunately situated, to find that, just as the hill was won, his camera had buckled and all that he had to show for his efforts was a quantity of twisted film. However, undaunted, the film manufacturers placed on exhibition scenes of the charge up San Juan Hill. The fact that his operator failed him at the crucial moment did not keep an energetic manufacturer from showing the fight in all its fury. In similar form Dewy's triumph at Manila Bay was shown, although there was not a camera man within five hundred miles of the scene of the conflict. Instead of being fought on a New Jersey hill as San Juan was, it is interesting to note, Manila's glory was passed on to breathless thousands by means of miniature ships belching forth their flame in the back yard of a Brooklyn studio.

With this wide-spread interest in war, negotiations were opened with Villa at the outbreak of the Mexican troubles. Promptly camera men were despatched to the border to bring back scenes of conflict, but in a territory so wide-spread and with fighting taking place from ambush with the greater number of casualties resulting from night raids, the photographers were able to bring back but little other than scenes of preparation. Prisoners were interesting, as were the scenes of confusion after a village raid, but the demand was for men falling in battle.

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Unable to get scenes they wanted, arrangements were made by a motion-picture company for exclusive photographic rights with Villa, with the result that from that time on Villa deployed and attacked only after approval on the part of the photographers. Night attacks were no longer made and fighting as much as possible was held between the hours of nine in the morning and five in the afternoon. But even with this agreement, the arrangements were not altogether satisfactory, for the reason that Villa wished to appear personally in the film to the exclusion of all else. The public was desirous of seeing the leader, but after a few different poses at his tent, on horseback, sweeping the field with his glasses, and conferring with his staff, the public was eager to see the sanguinary results of all this preparation; but this the photographer was not allowed to show, Villa requiring that he expose another picture of him in some new and unique pose.

With the coming of the European War, presenting quite a different phase of military tactics, preparations were made to film the progress of the conflict, but the film came under the ban of the censor so that little from the fighting front could be shown. The scenes as exhibited were those of preparation, parades, recruiting scenes, hospital care, and personalities of the individual heroes, but of the actual fighting front the censor allowed no films to be shown.

The present writer was in Singapore at the outbreak of the conflict taking motion pictures, and even with all the inducements that he could offer

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was unable to secure pictures of even local importance. In Calcutta and Bombay the restrictions were even more severe, so that the few pictures that could be taken had to be confined to native life, scenic views, and customs.

As the censor became more liberal photographers were not only granted permission to set up their cameras in the danger zones, but were given every assistance in making the picture a success. It was found that for war purposes the ordi-



GYROSCOPE CAMERA. TRIPOD UNNEEDED

nary camera setting on an accepted tripod was inadequate, with resultant preparations on the part of the manufacturers and photographers to meet the demands of the situation. A camera employing a tripod not only exposed the photographer to the attack of the enemy, but brought him to the particular attention of the marksmen by reason of the machine that he was turning, which

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as far as they were able to determine might be a new arrangement of rapid-fire gun.

To enable a photographer to take pictures of the exploding of enemy ammunition, a camera operated by a battery was brought to the trenches and set up under cover of night or during a lull in hostilities. This instead of being operated by hand was operated by motor power, so that by means of a battery and press-button the operator was able to avail himself of a spot less hazardous and yet where he would be able to operate the camera. Protected from the force of exploding bombs by a steel jacket around the box of the camera, the camera was further secured by wiring it and staking it down so that unless a bomb fragment came in actual contact with the camera it was able to stand the concussions of the fighting front. Equipped with a telephoto lens the enemy trenches were brought up to such a distance that their fighting equipment could be distinguished. Scenes from the film are often lacking, for the reason that the bomb concussion was so great as to upset the camera, so that it could be righted and further scenes depicted only after the passage of hours.

Cameras thus jacketed and staked to the ground were of no service in case of a charge, if the operator wished to show anything more than the evacuation of the trenches. Filming of advances must be accomplished in another manner. A camera to be used in an advance had to be not only portable, but must be one that would permit of quick adjustment and instant focusing. A gyroscope camera, the invention of Kasimir de Proszynski, was

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used in trench attacks with success. The camera, weighing twenty pounds, was swung over the operator's shoulder or held aloft, as the exigencies of the occasion demanded.

If an advance was to be made from a certain trench at a certain time the signal was announced by machine-gun fire, that all the troops might be in preparation. On the completion of the signal the troops came out of the trenches, with the operator advancing with them that he might show captures. With the camera operated by compressed air and held stable by the gyroscope disk, the camera man had his right hand free for instant adjusting of his gas-mask. As he advanced with the last line of troops he had only to watch that he did not step into shell-craters or stumble over intervening objects. The camera with its magazine of four hundred feet was able to show almost seven minutes of action without reloading.

In the siege of Verdun an incident happened illustrative not only of the dangers of trench photography, but also of the fine adjustment to be found in a well-equipped camera. A de Proszynski camera was in the hands of J. A. Dupré, a French operator, who had advanced with the troops and was stopping to find shelter for himself when he was killed without any injury being done to the camera. The camera was supported on his knees and with the slouching back of his figure the camera righted itself and, operated by compressed air, it continued exposing the film, using all the negatives before it came to a stop, thus finishing its task although the operator had been killed.

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With the opening of the war it was hoped that motion pictures for reconnoissance work by means of aeroplane would be of great service, but it was soon found that the vibration of the flying-machine distorted the pictures by reason of the comparative slow shutter used by the motion-picture camera. The film must stay in place a certain length of time before it can be advanced for a further picture, so that the exposures must be slow; with a still camera the picture may be taken at an exposure of as high as one five-thousandth part of a second. As a result, after a few experiments it was seen that aeroplane pictures would have to be confined largely to still photography. Pictures of aeroplanes in flight could be taken by movie cameras in other machines, but still cameras were best suited for ground views.

A greater part of military aeroplane pictures are taken from a map. The whole of the fighting front is charted, with the kilometers laid off by lines, with a number given to each block. Word comes to the photographic division to take a picture of Block 6, Square 5, Point 6. Immediately an aeroplane with a photographer is despatched with a corresponding map before the flyers. Arriving at the spot, the picture is taken at an altitude as low as possible. If driven away by enemy aeroplanes, the pilot and photographer ascend to a greater height and there expose as many pictures as possible. If the aeroplane does not return, or if the observation balloon shows that it met with disaster, another photographic aeroplane is despatched, and another, until finally the

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picture is secured. Even with the sacrifice of a number of lives and machines, the photo finally secured may show only a copse of woods seemingly of no strategic value. Such a picture was brought



Copyright by Committee on Public Information

MOTION PICTURES FROM AN AEROPLANE OVER ENEMY LINES

The Graflex camera is operated by a handle and trigger underneath, much after the fashion of a huge pistol.

back soon after the American forces assumed hostilities in France. When the successful picture was at last brought in it was a disappointment to the photographer and pilot, for it showed only a ragged clump of trees. At first they thought they must have misread their map, for as far as they could see it was merely a clump of trees such as could be found by the score over the fighting front. However, it met with quite a different reception by the cartographers. An examination by enlarging glass showed that directly in the center of

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the trees was a spot slightly lighter in color than the area immediately surrounding it. To the photographer this meant nothing; to the staff everything. The explanation was that a battery had been placed in the trees; one of the trees had been cut down and raised by means of trusswork over the gun. This tree had died, so that its withered gray distinguished it from its green companions. A battery was turned on the innocent-looking copse and the danger eliminated.

Shortly after landing on foreign soil, photographers with the American Expeditionary Forces received word to bring back aeroplane pictures of a certain suspicious spot which, so far as the eye could make out, was merely a group of innocent trees. However, when the picture was forthcoming it was discovered that around the trees was a small grayish circle. The picture was examined by several of the staff without attaching any value to the grayish ring until one of the officers applied to it the principle of cause and effect. His explanation was found to be the right one. In this group of trees lived a German army officer and this German army officer kept a horse. Each morning, or at least on favorable mornings, the horse was taken out and exercised around and around in a circle, as is the German custom, until the horse had beaten down a path grayer and more compact than the surrounding soil. The location of the trees was given to a battery, with the result that the horse had been exercised for the last time.

Of special value is panchromatic work in the

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taking of military photographs. The value of color photography to pierce smoke haze was discovered more by chance than by design. At a height it could pierce smoke camouflage that was impossible to black-and-white photography. For many months this was a well-guarded secret on



Photo by Paul Thompson

TRAVELING DARK ROOMS ARE USED IN THE FIELD FOR THE DEVELOPMENT
OF MOTION-PICTURE FILM

In less than an hour a film may be developed and printed for use by a topographical
officer.

the part of the American military forces, for the effectiveness of panchromatic photography had not been discovered by the German photographic division.

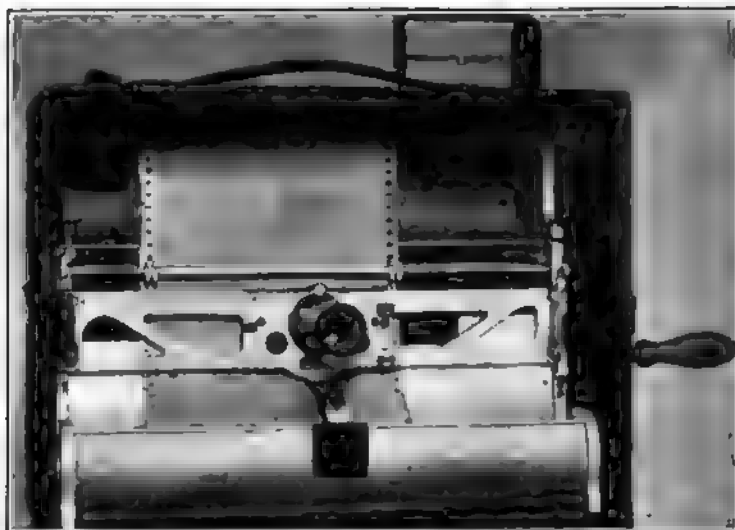
Realizing the increasing importance of motion pictures in war, two motion-picture projection-machines were installed in the Capitol. One was in a committee-room of the House of Representatives and the other in a room off the Senate Chamber where the Representatives and Senators were enabled to view the French and British war films

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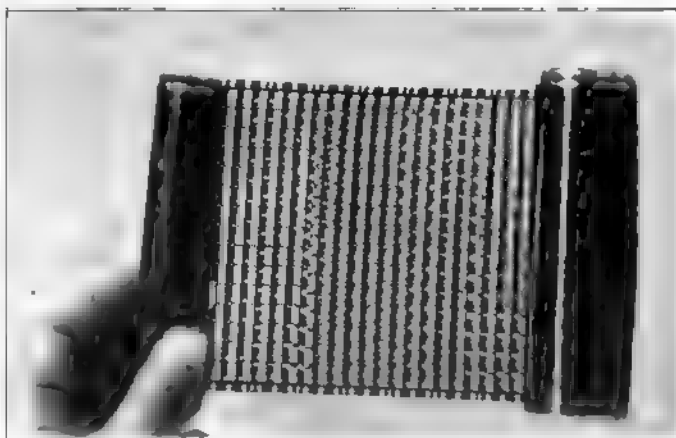
and also were able to see the progress made by our own troops in their drilling and preparations. Here uncensored films were shown with a showing to the general public of the parts passed by the committee.

In preparation, motion pictures were found, not only by military experts, but by congressional bodies, to be as important in the drilling of soldiers and in the teaching of marksmanship as in the gathering of information in time of conflict. Motion pictures may be used for the teaching of marksmanship by a means worked out and put into practice by the Animated Target Company. The motion-picture target, meant for better instruction in marksmanship, consists of an iron frame set up on a target range with a paper front looking something like the screen in a motion-picture theater. The paper which takes the place of the fiber screen is slowly progressed by means of machinery, while on the moving paper pictures are projected by means of a standard projector. The pictures are similar to those seen in a motion-picture theater, with the exception that the subjects are chosen for purposes of marksmanship rather than amusement. Pictures taken on the western-front battle-line, of enemy soldiers coming up out of the trenches and advancing, are shown on the screen at the size they would appear to the opposing troops who were called upon to repel them.

Behind a prescribed line soldiers drilling in marksmanship are required to stand and to fire at the enemy. With the firing of a shot the motion pictures on the paper stop while a light appears showing the location of the shot. The light



OKO CAMERA, WHICH BOTH TAKES AND PROJECTS PICTURES. SHOWING
WIDTH OF FILM USED



STRIP OF FILM FROM OKO CAMERA
The pictures are about the size of a baby's finger-nail.

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appears for two and a half seconds that the marksman may see the effect of his shot and so determine a better placing. At the expiration of the two and a half seconds the pictures continue their activities and the moving paper screen closes up the hole, giving the marksman a new pose for his aim. The picture may show a bombing squad coming up out of a trench, and by the stopping of the film and that of the paper the light shows where the shot took effect, so that the experimenter may better place his shot on future occasions. Marksmen able to make perfect scores on a bull's-eye target find their drilling of little service for placing shots on a moving target.

By an arrangement of lenses the objects on the screen are of the size they would appear to the soldiers in the trenches called upon to repulse an attack. Thus the marksmen are given preliminary practice under conditions that will have to be faced by them later on the firing-line.

XII

ADVERTISING BY MOTION PICTURES

THE advertising world, quick to utilize means of arresting attention, was soon attracted by the possibilities of motion pictures to put sales arguments before the public. Just how to go about presenting propaganda films was the question that advertisers faced.

Even should a manufacturer have a film made wherein was shown the course of manufacture and even though the factory process was an interesting one, he had no means of getting distribution. Exhibitors were under contract to take all their films from one manufacturer of dramatic film and could show outside films only under penalty of violation of agreement. As a result manufacturers wishing to exploit their materials by means of motion pictures had to secure circulation by means expensive only as it was unsatisfactory.

A shoe firm in St. Louis, one of the pioneers in propaganda presentation, had a film made which told in narrative form the story of the shoe from the time it was on the cow's back on the range until it was on the shelf, by following a piece of leather from the time the cattle were rounded up by picturesque cowboys until the shoes arrived at

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and appeared on the shelves of the local dealer with a pleased customer to bear them away in triumph. With the film complete it was sent out with a lecturer on a tour of the small towns, who engaged halls and, working in co-operation with the local dealer displaying that particular line of shoes, gave a free performance to prospective buyers. Tickets had been sent the local shoe man in advance that he might give them out discriminatingly. A theater was engaged for a morning performance, when the lecturer delivered a talk on the making of shoes, while the picture showed advantageous scenes from the factory. Little difficulty was found in securing audiences, for motion pictures were a sufficient novelty to secure attendance, but means of exhibition thus secured was not entirely satisfactory, on account of the limited number to whose attention the film could be brought. With the expense of the lecturer and the item of the theater, the cost per person made this means of advertising unprofitable. Outside of the matter of expense, even with a number of lecturers the film could be brought to the attention of only a few hundred thousand in the course of a season. Some more universal and some cheaper means of distribution must be found to make film display satisfactory from the standpoint of the manufacturer.

With the breaking up of the program system by which exhibitors were bound to accept the offerings of a certain manufacturer or group of manufacturers, advertising firms received an impetus, for if they could be made in such a way as not to have the advertising too apparent exhibitors would

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be glad of the chance to put the films on at the lesser sum demanded for them than for the dramatic films. Accordingly films were made of pro-



PERFORATING-ROOM OF AN INDUSTRIAL FILM PLANT

The holes are not put in the film till it is ready for exposure, to keep the film from warping and becoming distorted.

prietary articles wherein the advertising matter was subservient to the story or educational interest. If a manufacturer of soap wished to bring his particular brand to the attention of the public he originated a semblance of a plot to carry his factory scenes. Before the story was over the audience would have seen the making of soap, with a pointing out of why it excelled competing brands in points of excellence, with probably a bit of trick work for a close. One film, in particular, showed

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the arrival of a mail-order box of soap at the home of a delighted purchaser, with the husband trying to find a hammer to open the box. While he was out of the room the box opened itself. As might be imagined, the scene, from the point of execution, was accomplished on a black background. The boards were pulled up a bit at a time, while the camera was stopped, and then a few exposures made of them in their new positions. The boards, as they were about off, were held in position by fine wires invisible on the black curtain, so that the audience left the theater with not only the name of the soap impressed upon their minds, with its claims for distinction, but also with a pleasant recollection of the film and wonderment as to how the box was made to open itself while the husband was out of the room.

As the manufacturers became more willing to have films taken without too great a wealth of publicity for themselves, exhibitors became more willing to show films to their audiences as part of the regular program. A manufacturer who wished to accelerate the sales of his commodity had two versions of the film made for distribution. If he was the maker of tooth-brushes he had a film showing the different processes of manufacture, with his name prominently displayed not only in the subtitles, but also in the background on packing-cases, walls, and office doors, but this version could be given only to audiences selected by himself. To salesmen it was given who hired halls and gave demonstrations as best suited their advertising campaigns, but if the manufacturer wished to show

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the film to the general public through film exchanges he had to extirpate in a great way all the advertising matter contained in the film. With the elimination of his name and address and the name of his proprietary article from the subtitles, with the only showing seeming to be a chance one when a packing-case was being put on a steamer at the docks or on a freight-car at the yards, then the exhibitors were willing to show the film, thus assuring unlimited circulation to the film. By reason of the educational value of the film, exhibitors were willing to run it when the advertising matter seemed only incidental. Although shorter in version, often covering no more than four hundred feet, manufacturers were willing to make the film and to give it to the exhibitors free of charge for the wide audiences that it would reach.

With the growing popularity of the animated magazines, a new field was offered to manufacturers who wished to have their products given motion-picture publicity. These film services, endeavoring to take the place of magazines, were a means of distribution for short informative films. They were willing to exploit a product without charge for its popular interest, provided that no advertising should appear. In this way a manufacturer of machines for resuscitating drowned persons had his machine called to the attention of millions in a week. An exhibition of his machine was given. A man supposed to have been drowned was carried in by the rescuers, while a pulmotor was telephoned for. The operator bringing it in left the carrying-case on the table with the front

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facing the audience. In small letters on the case was the name of the manufacturer. His name appeared in no other connection. The demonstration was given for the benefit of the indirect advertising, while the film company was willing to offer it to the exhibitors on account of its novelty and wide interest.

With the advance in projection-machines, new and tempting uses came to hand for the manufacturers. The projection-machine, as found in the theater, is beyond the possibilities of transportation without the aid of a truck, and even though it was brought to a hall it must be accompanied by a metal- or abestos-lined booth. As long as only a standard projection-machine could be used in the showing of films the possibilities of individual distribution of propaganda prints were limited, but with the invention of the portable projector a new field of advertising and sales effort was opened to the manufacturers.

By means of a small projector operating from an incandescent bulb instead of from an arc-light, a salesman was enabled to go into a prospective customer's office, draw the blinds, and on the walls of the office show his machine not only in course of building, but also in operation. Such means of salesmanship was found to be especially valuable to manufacturers building machines not easily transported to the office of the prospective buyer. The manufacturer of a steam-shovel could not only show the careful workmanship that went into the construction of his machine, but also could show it in operation in Paraguay or Panama. Enabled to stop the machine at any point desired,

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without danger of setting fire to the non-inflammable film; the salesman was able to call attention to any particular joint or point of excellence.

With a portable machine weighing not more than twenty pounds a salesman was able to carry it,



ARRANGING THE SCENES IN THEIR PROPER SEQUENCE

When the film is torn it can be mended and put back together again in a few seconds.

as he would a suit-case, to the office of an interested person and in a few minutes give a demonstration that might consummate the sale of a shovel.

If the desire was to bring the product to the attention of the passing public it could be accomplished by installing a continuous projector in an advantageous position. Set up in a store window, the machine without attention 'would show' the film to all passing observers who wished to avail

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themselves of the opportunity. The machine was so constructed that on completion of the showing of the film it would reverse itself automatically and exhibit the same film again without rewinding or attention.

As the opportunities of distribution and use of motion pictures grew, manufacturers became more and more interested in the new means of advertising. Unacquainted with the process of manufacture, they approached companies interested in the making of dramatic film to employ them to make factory films, but manufacturers of dramatic films with their resources taxed to meet the demand of the exhibitors received their advances with little enthusiasm. The work for which they were equipped and for which there was a constantly increasing demand made them look on outside orders with scant attention. As a result manufacturers found difficulty in having films made to meet their sales requirements.

In 1910 Watterson R. Rothacker, of Chicago, organized the first company to give its entire attention to the manufacture of commercial subjects. Through the efforts of his organization he was enabled to take over the responsibility of filming subjects of exploitation.

Business houses wishing to have their product put in film form either for general publicity or to further the efforts of the sales departments made their wants known to the manufacturers of commercial films, who submitted estimates. It was soon seen that a film merely showing the process of manufacture held little interest to the public

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in general, so efforts were made to bring into the film the romance of the business. A manufacturer wishing to exploit the advantages of his automobile tire had more made than a film showing the machinery of his factory turning out his product;



THREE SETS BEING PHOTOGRAPHED SIMULTANEOUSLY IN A COMMERCIAL STUDIO

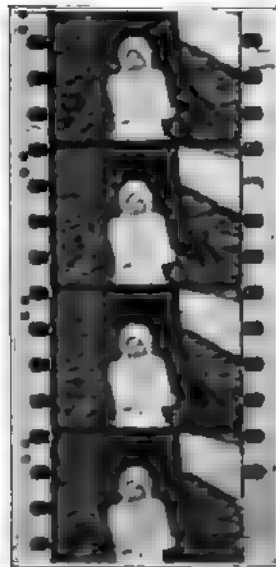
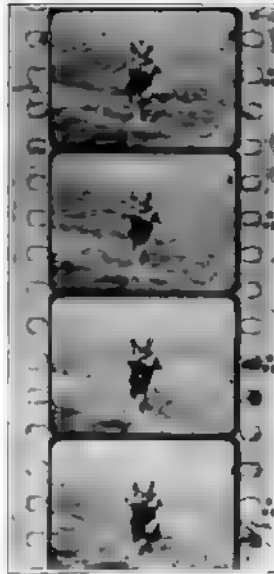
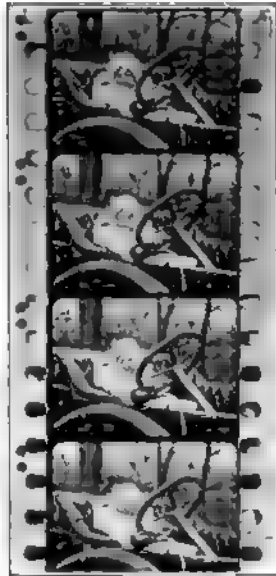
Overhead may be seen the long radium lights for the illumination of the scenes.

additional interest was lent the film by showing the natives of South America hanging their buckets on the spiles of the rubber-tree and carrying away the sap. The first process of manufacture, as achieved at the source of production, was shown with the crude product leaving for New York to be carried inland to the factory. The course of the crude material was shown over the factory until it came out as a completed tire with the accepted pretty girl riding joyfully away on the buoyancy of that particular brand.

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In submitting an estimate for the filming of a commercial subject two things are taken into consideration by the film manufacturer. One is the number of exteriors and the other the number of interiors. Before a price can be quoted the film company must see the scenario from which the film is to be made. The cost depends much on the number of exteriors. The story is gone over and divided up into exteriors and interiors, as in the instance of a dramatic film. A certain number of scenes will be taken outside the factory, with some on the street and some possibly a number of miles away. For the factory scenes wiring preparations must be made, as few of the machines can be moved outdoors or to a suitable light. Portable arcs are taken to the factory and the machines illuminated to meet the requirements of the photographer. Even though the machinery may be in the basement or underground it can be photographed by reason of the artificial illumination.

If studio sets are required the commercial filmmaker furnishes these, for he carries in stock sets that will show a humble home or, if need be, he will meet ducal requirements. If a scene calls for sets that he does not have, he has them made to order or secures the furniture from a store equipped elaborately enough to give him a selection. Furniture and period finishings are rented to film-makers at one-tenth of the sales price for each day the properties are away from the store. Thus a film-maker wishing to show an elaborately carved Chinese table pays one-tenth the sales price for each day that he has it in his possession.



AS THE CHILD GROWS OLDER

Much of the work of a commercial studio is that of photographing children for their adoring parents.

HOW MOTION PICTURES ARE MADE

The rate of payment for commercial film depends on the number of exteriors and the number of interior sets. For interior sets where the film company has to furnish the lighting apparatus a dollar a foot for the negative is the standard price. For exterior scenes the rate is fifty cents a foot, with ten cents a foot additional for positive prints, with the same rate for titles and reading-matter. If the factory at which the film is to be exposed is out of the city, the traveling expenses and the living expenses of the photographer are added, equaling approximately ten dollars a day. From a negative the manufacturer may have as many prints made as he wishes. Thus a film with half the scenes interiors and half exteriors costs the manufacturer for the first print to run through his exhibiting machine \$750 for a standard reel of one thousand feet.

From a different angle motion-picture publicity was approached by Henry Ford, automobile manufacturer of Detroit. Instead of hiring lecturers, or making distribution of films showing scenes from his factory, he opened a motion-picture department with camera men to take pictures, not of his factory, but of events of local interest. These were given to the theaters in Detroit for free use under the name of "The Ford Weekly." The reception accorded the project encouraged him to operate on a wider scale by taking pictures of news interest throughout the state and to send prints on a circuit, for the use of one theater one night and for another theater the following night, with no charge to the exhibitor.

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With the success of this came calls from adjoining states, until now it is on daily exhibition throughout the United States and in South America. In addition to films of news interest, educational scenes are used wherein are shown such subjects as the tanning of leather, the blowing of glass, and scenes illustrating the volcanoes to be found in American territory and our national works. Negative is secured both by camera men in the employ of the company and by free-lance photographers submitting material on approval. The film is sent to theaters wishing to display it, with the advertising limited to one line on the initial title, whose chance for laudation is taken advantage of only by the simple statement, "Produced by the Ford Motor Company." The film is seen by four million people a week.



INDUSTRIAL SUBJECT

On a more restricted basis motion-picture films are used by companies to advertise to their own employees. Here their use is not so much one of exploitation as one of instruction. The Pennsylvania Railroad, wishing to instruct its employees in methods of safety, accomplished it in a film showing a story wherein was depicted the experience of a foreigner coming to these shores and what

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he had to learn to become a competent workman in a large railroad shop. Methods for him to protect himself, to protect others, and to safeguard the public were shown, with a lesson as to what happens on neglect of duty. A railroad car, equipped with a projecting-machine and a screen, seating forty-eight people, was sent out on the different lines controlled by the Pennsylvania, so that sooner or later the picture would be seen by each employee of the organization. The increase in safety to the public and the decrease in the number of preventable accidents justified the expenditure.

With the success attendant upon motion-picture advertising, novelties began to appear. By means of motion pictures advertisements were shown on daylight screens at positions advantageous to crowds. Using motion pictures as a base, but of a different appeal, was the advertising novelty offered by the Animated Target Company, by which a firm might display its product in animated form in motion-picture shooting-galleries. In place of the metal ducks and clay pipes that took their way across the shooting-space in orderly succession, motion pictures were used to throw on the screen moving targets. The picture may be that of a deer as it dashes across an open space in the woods. With its appearance on the screen the hunter fires. As his bullet strikes the paper on which the pictures are appearing, an electrical contact closes, disengaging the projecting-machine so that the picture stands still two and one half seconds. With the striking of the bullet on the paper a point of light

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appears so that the marksman may study the placing of his shot. At the expiration of that time the deer again resumes its motion, permitting of as many shots further as the hunter wishes to fire.

For advertising purposes the deer is replaced by propaganda with some point of interest for the marksman to try his skill on. The inducement may be an advertising trade-mark animated for the purpose. A trade-marked pickle may be made to disappear in and out of a bottle, or the Gold Dust Twins may be made to juggle plates as offers for marksmen, while not only the marksman, but the onlookers, have the trade-marked articles called to their attention anew. Operated by the same controlling company, the advertising appears in a chain of animated target-galleries over the United States, with the charge to the customer based on the number of feet of film consumed by his display.

XIII

PICTURES IN COLOR

NO sooner had it been established that pictures could be projected in motion than experimenters began to attempt to show them in color. In fact, pictures in color had been thrown on the screen before the taking of the first motion picture in its present form, but these pictures, as may be surmised, were not in motion. They were what is known as lantern slides.

By a process evolved by Frederick E. Ives, of Philadelphia, in 1889, which, as we know, antedated the projection of the first motion picture by five years, objects in color were thrown on the screen in stereopticon form. Exposures were made in red, green, and blue on three different plates, which, when superimposed, threw on the screen objects in natural colors. But the hiatus between colored lantern slides and colored motion pictures was a gap to require the efforts of many workmen to bridge.

Study of the situation soon revealed that the method of taking would have to be simplified so that two or three colors in varying combinations would suffice for all, as in the mixing of artist's pigments. Attention was turned to the three pri-

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mary colors, as taught in the school, hoping that in them the solution lay, but it was found that there was a wide discrepancy between pigments and colored lights. The primaries of the school—red, yellow, and blue—were found to be far from the primaries of the spectrum. These three pigments mixed in proper proportions would give any desired color, but when transmitted to the screen they had no such chromatic blending. The explanation lay in the fact that motion-picture film is a medium only for transmitted light, while pigments get their luminosity from reflection and their hues from selective absorption. Resulting investigation showed that these three primary colors from the point of view of transmitted light are red, green, and blue-violet. With them may be approximated the remaining colors.

Even with the establishment of the three primary colors of which white light is composed the solution was merely begun, for some method must be discovered by which they could be reproduced by the film. The simplest method and the one that immediately suggested itself was the use of a filter which would exclude all colors from striking the film except the ones desired. Glass, always a medium easily colored and readily convertible, was selected by W. Friese-Greene in England as the means of making this possible. Since the rays must be broken up before they reached the film, he interposed colored glass through which the light must pass on its way to the film. One segment was red, the second green, and the third violet, all held in place by a metal mount which would re-

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volve in co-ordination with the advance of the film. His plan was to break up the rays in their passage to the film by the three-colored wheel and then again in projection to revolve the color-wheel three times as fast as the speed with which the film was passing, so that all three color segments would pass in front of each frame while it was being exposed on the screen. He hoped that the light passing through the three color segments on its way to the screen would assume its original colors, but experimentation showed that the process was not the right one.

He soon gave up work on this method to try a plan of interposing a prism in the rays passing through the lens. By this prism two sets of images were exposed side by side on the negative, each with a different color image. This method he demonstrated before the Photographic Convention of Great Britain at Southampton in July, 1906.

From Friese-Greene's original method of breaking up the light on its way to the films and restoring it again on its way to the screen, Lee and Turner evolved a more mature plan, but instead of trying to photograph three color images on the same film they experimented with and patented a process in 1899 by which three color images were photographed successively instead of on the same frame.

Even with a means of transmitting color values to the film the problem was far from being solved, for unexpectedly it was found that, although sound in theory, color values did not work out as was expected. The trouble lay in the different chromatic values of the colored segments. As is known,

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color is light rays vibrating at high intensity, with red constituting the longest rays and the shortest waves having a violet tinge. When the colored segments were mounted and the film run through, exposing one frame to red and another to green, it was found, by reason of the unresponsiveness of the negative film to light of long wave length, a negative correctly exposed for red was inadequate for green with a shorter wave length. The result was that the negative would reveal one frame of the correct exposure, with the following one too thin for satisfactory printing.

To offset this an endeavor was made to discover some way of making the film sensitive to light of all colors, so that the red ray would as rapidly define itself on the emulsion as the green ray. Such a process was discovered shortly, but its achievement was a long and trying strain, for the work must be done in a room darkened from all light, even excluding the customary ruby lamp, which would cloud the film.

With a film finally evolved that was "panchromatic" work was again resumed by color experimenters. Hope rose when it was now found that the film exposed all light rays with equal fairness, but when it was projected on the screen an unexpected inadequacy showed itself. Projected at the rate of black-and-white films of sixteen pictures to the second, it was seen that the rate of speed was not sufficient to blend the color images in the eye. At this low rate of speed the eye could pick out one color from another. The eye was able to detect that one frame was all red and the following

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frame all green. To offset this an effort was made to project the film through the machine at twice the normal rate of speed, but the machine built for projection of sixteen pictures could not attain a speed of thirty-two pictures to the second. New machines were constructed and pictures in color projected with some success.

Inspired by the success of Lee and Turner, the work was taken up by George A. Smith and Charles Urban, of England, who exhibited at the Royal Society of Arts in London in December, 1908, a color process which they called Kinemacolor. It made use of the two colors, red and green. It was brought to America by Smith and made a commercial success. By the Kinemacolor process colored motion pictures of the Coronation, of the Durbar in India, and of lesser events were shown in New York and Eastern cities.

The pictures were projected at such a rate of speed as to make an unpleasant eye strain, with the result that after the first curiosity of seeing motion pictures in natural colors they were taken off and work resumed to more nearly perfect them.

Léon Gaumont, studying the matter of color projection, came to the conclusion that eye strain could be relieved by projecting pictures in the three primary colors, which, blending, would give the more natural tints. His experiments culminated December 6, 1912, when he projected in his theater in Paris the first motion picture in three colors. Instead of using a two-color cycle, with alternate color impressions on alternate frames, he exposed three images at the same time with differ-

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ent color impressions on each. These three images he was able to bring to the negative at the same time by a triple lens. The images as they appeared on the negative were no wider than the accepted ones, but lengthwise of the film three of the Gaumont images occupied the space devoted to two ordinary black-and-white images. Each image of the set of three recorded the same story and the same action, but on one image only red rays were exposed, on another only green rays, while on the third only blue-violet rays were allowed to penetrate. The film was projected at twice the rate of speed of black-and-white pictures, so that double the amount of footage was required to show the same scene.

Although the colors were blended with some success, there was another handicap not easily overcome. To show the trichrome pictures a special projecting-machine was needed. This meant that small theaters, unable to meet the additional outlay, sent in no call for the film, making, as a result, the process commercially unsuccessful.

After a few exhibitions, viewed more in the nature of a novelty than a necessity, color photography received no further impetus until February 8, 1917, when in the American Museum of Natural History in New York a four-color process, given the coined name of Prizma, was shown. As Kinemacolor employing two colors was to be succeeded by Gaumont using three colors, so Gaumont was to be replaced by Prizma subdividing the spectrum into four colors. This subdivision was made by the combinations of red-orange, bluish-green, yellow, and blue-violet.

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Resolved to its simplest, the process is in the main a doubling of the Kinemacolor method. A panchromatic film is exposed through a revolving color-wheel consisting of four segments, but it is projected through another color-filter containing two color divisions. The rate of projection is thirty-two pictures to a second.

To the casual eye a strip of Prizma negative differs but slightly from a monochrome film, but there is a variation in luminosity. Although this is not apparent to the unaided eye it is easily brought out in projection by the aid of the color-filter.

In taking Prizma pictures the camera is fitted with a glass wheel divided off into segments of the four colors, which is made to revolve as the film is being exposed. This gives the frames in cycles of four a different luminosity. When the picture is projected a similar color-wheel is again used which restores the color impulses. If the film could be stopped and examined it would be found that one frame, as shown on the screen, would be red, roughly, with the one following blue as the film is projected through a wheel employing segments of only two colors.

An observer sees a fairly accurate mingling of color for the reason that color stimulates the eye longer than the absence of color. If he looks at a red rose and turns his head the color impression remains on the retina of his eye longer than if he had observed a printed paper devoid of color. Thus the eye in observing motion pictures carries over the stimulation of the red in the combination of the

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first two color segments until the second two, consisting of yellow and blue-violet, as used in the taking filter, appear on the screen. Projecting with only two colors, the eye had but to carry one color from one frame to another, when the two colors overlapping give a fairly accurate blending of the colors as found in nature.

A curious phenomenon was noted by the author in observing the Prizma process, well illustrating the color composition of the pictures. One film, as exhibited at the Jersey City laboratory, showed a Japanese girl sitting in a fishing-boat at a wharf in San Francisco, bedecked in the bright colors loved by Japanese girls, making a picture particularly suited to the needs of the motion-picture color-camera. On the girl's lap was a dog, and as the photographer turned the handle of his camera the girl began to grow more and more nervous, making her fears manifest by stroking the dog's back with increasing rapidity. As her hand began to go faster and faster, the colors were broken up by the rapid right-angle motion until they were resolved into the two dominant hues of the projecting filter—orange-red and blue-green. The rapid motion at right angles to the lens of the camera broke up the color combination into its constituents, thus revealing another limitation to the average system of successive cinematographic color reproduction. While it could well be used in photographing scenes from nature, such as the beauties of a flower-garden or the brilliancy of a sunset, its possibilities in story form are limited for the reason that it would not be able to repro-

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duce the rapid gestures needed by the actors in making some of their scenes effective.

The matter of color is one requiring long study even in such a seemingly simple thing as reproduction in monochrome, for colors as reproduced in black and white are variable in their intensity and saturation. Yellow photographed on a black-and-white film under an arc-light is very different from the same color photographed in the open sunlight. This has led to curious situations that actresses and actors have found themselves in. An actress may be photographed in a yellow sweater in a studio scene under radium lights, to appear a few moments later under the trees in the same yellow sweater, but the shade of the sweater has changed so that the audience believes that she, in passing from the fireside to the flower-garden, has adorned herself in a different piece of wearing apparel.

To preclude such seeming inaccuracies with each gown, in the wardrobe-room of the motion-picture companies is a color-chart which shows the color values which the gown will photograph in different lights. The value not only for sunlight and electric light is given, but the values it will have when the film is tinted for fire scenes, candle-light, and moonlight. Knowing the scene that she is to appear in, the actress has only to refer to the chart to determine the color shade it will have when thrown on the screen.

While experiments were being conducted to reproduce by a photographic process the colors of nature, a more direct, even if more tedious, method was being employed by other experimenters in the color field. This was hand-coloring.

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Curiously enough, the first motion-picture film ever made was shown in colors, as we have seen. Made in the back yard of his boarding-house in Washington, Jenkins had the film depicting the terpsichorean powers of Annabella done in colors by Mrs. Boyce, who painted each frame by hand. The success of her colors, it was noted at the time, was more commendatory for brilliance than accuracy.

Practically all recent coloring other than that of photographic process has been done by machinery, applying the color direct to the print. To do this a stencil is cut out and placed over the figures and the scenes in the frames so as to protect from application of color parts that are to remain neutral, much after the manner of stencils used in applying shipping names and directions to packing-boxes. With the stencils properly adjusted the film is run through a machine fitted with revolving brushes, which, as the film is progressed along, apply the color. One color at a time is given the film, so that if it is to be shown in three colors it has to go through the coloring-machine three times. Each print has to be colored, as all applications of color are made to the positive rather than to the negative. Tedious as such a process is, it is far more rapid and correspondingly more successful than painting each frame by hand.

The effect of coloring by stencils, while often pleasing, is no rival in fidelity to the original of the more successful photographic processes.

Even though color photography has not justified its early promise, with the successful solution not

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yet hit upon, monochrome effect on the screen is varied successfully by a different process. The picture is photographed in black and white and a value given to a particular scene through tinting it by washing out some of the silver salts in the positive. A scene indicating night may be taken at full noon, but when given a blue bath the resultant effect is that of the desired hour. For candle-light the film is immersed in a yellow bath and when the lovers are united before the fireplace in the inevitable final act the scene is made realistic by dipping it in a red bath. By tinting and toning and a combination of both, varied effects can be given the black-and-white positive, relieving the monotony of the monochrome. Thus a scene depicting nymphs dancing at a fountain takes on the brilliancy of outdoors by giving it a rose tint over a green tone without necessity of hand-painting or stenciling each frame in its natural colors. As the tints and tones are then in the positive, the film can be projected through a machine without additional equipment.

Such are the varying methods of giving color values to the film as have been used and are used to-day, although the final solution has not yet been reached. However, a number of experimenters are working on the problem, so that any day a triumphant process may be announced. To a person able to make such an announcement and substantiate it by a demonstration, money will be his at a rate pleasant to contemplate even by a person whose association with its success is no nearer than that of spectator.

XIV

TALKING-PICTURES

SO far ahead of their machines do inventors keep that long before they had succeeded in projecting a moving picture on a wall, experimenters were devising ways and means of making pictures talk.

February 27, 1886, Edward Muybridge journeyed from Philadelphia to Orange, New Jersey, to consult with Edison about working out a plan by which Muybridge's Zoopraxoscope and Edison's talking-machine might be united so that the pictures on the wall might seem to be speaking. As we have seen, this was eight years before Jenkins projected his first motion picture at Richmond, Indiana.

Strangely enough it was decided that the plan was impracticable not through any shortcoming on the part of the motion-picture machine, but by reason of an inadequacy on the part of the talking-machine. Synchrony was dropped because it was decided that the talking-machine, as devised, could not speak loudly enough to make itself heard to a theater audience. Had they only known it, the talking-machine was to reach success long before the motion-picture machine. The motion-picture machine as then used was soon to be discarded, to

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be worked out years later on an entirely different principle, while the graphophone as used to-day is merely a rebuilding of the machine then existent.

For the time being Edison abandoned the plan of synchronizing the talking-machine and the motion-picture machine to return to it with the completion of his Kinetoscope. Again it was taken up when he issued the Edison Vitascope under the Jenkins-Armat patents, each new form of the projecting-machine stirring him on to renewed endeavors. Nineteen years in all he spent on it, finally to put it aside for opportunities more promising.

With the appearance of pictures on the screen, means were at once taken to give them properties of the older stage. Accustomed to dealing with sound as well as motion, experimenters could not believe that sight alone would hold an audience. It was thought that the eye must be reinforced by the ear to gain the approval of the spectators, and to this end they set themselves. With the appearance of characters or objects with which sound is customarily associated a similar sound was produced in an endeavor to make the scene more realistic to the audience. Behind the curtain, out of sight of the audience, was an employee of the theater surrounded by drums, whistles, bells, and different noise-making paraphernalia whose duty it was to reproduce noise appropriate to the scene. When the fire-wagon appeared in response to an alarm he rang a bell, when the train rounded a curve he whistled in imitation, and when the waves of the ocean piled up on the shore he

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manipulated the gravel-box, but not always in as close juxtaposition of time as a critical observer might wish. Intent on a sandwich behind the shelter of the curtain, he was prone to wait till the ocean had been replaced by a pleasant pastoral scene to stimulate the minds of the audience with his mechanical apparatus, and often he was so occupied as not to fire the shot in the quarrel scene until after the body had hit the floor. Whatever imperfections he might have in the quieter scenes, no criticism could be offered as to his rendering of a battle spectacle, for the firing not only began promptly, but often continued until after the hero had married the girl.

Better to reproduce the sounds inherent to the scenes, inventors set to work to perfect machines that would eliminate the number of men needed behind the curtain to interpret properly any scene that might be offered. These machines were soon on the market and so perfected that one operator was all that was necessary to reproduce all the sounds needed in the course of an evening's entertainment. Although scarcely larger than an upright piano, one of the noise-machines would not only reproduce the clatter of the officer's horse on the pavement, but would carry on a battle from the first faint detonations to the fury of the final fusillade. When the train came to a standstill, the steam would exhaust and the trunks would be thrown on the platform with realistic thuds. At sunup the roosters would crow, the wife shrill and rattle her spoon on the crock, while in the trees the birds would twitter in tones that left no doubt but

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that they carried even to those in the audience least fortunately situated.

However great the success of the machines might be in reproducing sound, they still could not speak. That alone, it seemed to the exhibitors, was lacking, and as a result plans were devised by which voices could reproduce the words that the characters on the screen would naturally speak. With the films was sent to the exhibitors a manuscript that contained the lines that the actors had spoken in the different scenes in the filming of the play. Sufficient numbers of carbon copies were sent that the theater manager might distribute them to the actors he had engaged. After a few rehearsals the interpreters attempted to go through the scene before the audience. As the play might call for twenty characters, expense made it prohibitive on the part of the exhibitor to engage a corresponding number of actors, so each actor was required to assume a number of rôles. This he was able to do by familiarizing himself beforehand with the scenes and changing his voice to fit his interpretations of the different characters. Inadequacies in rendition of the characters were to be noted, especially by those seated near enough the front to have a location sense as to where the voice was issuing from, making it somewhat disconcerting to have a character show on the screen as being to the left and then to have his voice issue several feet away to the right. Again the shortcomings were felt when the characters attempted to move around behind the curtain to approximate the place where the figures on the screen stood with the creaking of

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the boards making their moves evident. Further imperfections were brought to the minds of the audience when the lights used in illuminating their manuscripts sufficiently to be read were to be seen by the people in their seats or when the actors behind the curtains took advantage of scenic views to discuss personal affairs in whispers audible to persons in the first rows, who were more interested in the story than in the family affairs of the interpreters.

While substitutes and makeshifts were being tried, Edison was continuing his experiments to perfect synchrony between the phonograph and the projector. This he was able to announce and on the market appeared the Edison Talking Pictures, by which one might see the characters move their lips and at the same time hear words framed and issued from approximately the same position on the stage as occupied by the characters on the screen.

The method of co-ordinating speech and action was effected by means of either cylinder or disk-using talking-machines. To the studio where the play was being enacted the reproducing horn was taken and plates made of the different scenes. As original gramophone records can be produced successfully only when the voice is transferred directly to the wax surface by means of a vibrating cutting-stylus at the end of a sound-conveying tube, this meant that the characters must be grouped around the horn to deliver their lines. It was found that reproductions on the cylinder could not be made when the characters stood on the stage at the

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points necessary for the interpreting of the scene from the point of view of action, and as a result plans to photograph the scenes and record the dialogue at the same time had to be abandoned. To meet this difficulty the lines of the play were first transcribed to the wax cylinders by the cast standing as closely to the horn as they could be grouped and delivering the words as nearly in time to the action as possible. From the original wax cylinder or from the coated zinc disk the sound records were transferred to the permanent reproducing cylinders or to the disks and the scenes played over again in accordance with the records which were reproduced by means of a loud-speaking horn for the benefit of the actors. While the words were being repeated the actors practised their parts in an endeavor to fit their actions to the dialogue. After a sufficient degree of accuracy was obtained, the scenes were filmed. The whole was reproduced for the benefit of an audience by setting up a talking-machine either behind the curtain or in front of it, out of view of the audience, but governed by the operator in the projection-booth. This was accomplished by means of electric wires running from the operator's booth to the synchronizing appliances that governed the speed of the talking-machine, the control of the movements of the needle being secured by means of electro-magnets operated by electrical contacts. Before him in the booth the operator had a control-board which showed the position of the needle on the talking-record behind the scenes. By swinging his electro-magnet commutator to the right or left the

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operator could increase or decrease the speed of the talking-machine to correspond with that of the picture-projecting machine. If the film lagged behind the words as they were being spoken by the talking-machine he had but to turn the handle of his projecting-machine until the words and action were in unison. If the words anticipated the action he delayed the projection correspondingly.

Machines employing the same general principles not only of projection, but also of reproduction, appeared under different names, but the success of the Cinaphone and the Vivaphone was short-lived. Greater success was achieved by Léon Gaumont when he exhibited his Chronophone before the French Photographic Society, November 7, 1908, and with his Filmsparlants which he presented before the French Academy of Sciences, December 7, 1910. His talking-films were pronounced a success by the Academy, whose members declared that he had for once and all solved the problem of vocalization. However, a short trial showed that the problem of talking-pictures was as far from a solution as ten years before, when he had experimented with his first machine.

Synchrony between film and disk could be attained, but prevention of the film breaking was impossible. When the film was rejoined it meant that several frames were missing, necessitated by the elimination of the torn parts, which naturally made the balance between sight and audition correspondingly difficult to attain. The insertion of a blank strip of film meant that when the scene was put on again the characters would go on talking when

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the screen was devoid of a scene. Each break and consequent mending meant additional hiatuses, so that after a few showings a talking-film would become an object more suitable to merriment than wonder.

After ten years of experimenting, Léon Gaumont, the most active exponent of talking-pictures, gave up further efforts, not so much on account of the difficulty of attaining synchrony between film and disk, but from his observations that talking-pictures were psychologically wrong. His conclusion was that there was more stimulation for the mind when it did not have the accompanying words, even though they were in unison with the movements of the character's lips, for the reason that the mind found pleasure in filling out the words that the characters would employ and in interpreting the meaning of their movements. The lack of words was that of the attraction of a picture puzzle. It left just enough for the mind to make its solving a stimulation. On forming this conclusion, M. Gaumont retired from the field of talking-pictures to devote himself to what seemed more promising phases of the industry.

Not so sure that talking-pictures were psychologically wrong was Elias E. Reis, of New York, who maintained that an audience wanted the stimulation of sound, or otherwise all plays would be given in pantomime. The possibilities of being able to give an audience not only the living features of an actor, but also his voice, stirred his imagination, and to perfecting a device that would make this possible he gave his attention. Already an inventor of some note, he felt that the accepted

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method of synchronizing the two machines was wrong. To a method of reproducing harmonious action and words he devoted himself, working on the principle that in order to produce practical results the film itself must contain not only the pictures, but also a record of sounds pertaining to the subject, and that this record must be of such a nature that it could be transferred to any number of positive copies of the original film in such a manner that the combined picture and sound records could be reproduced in synchronism.

Remembering the experiments of Tyndall, Koenig, and Helmholtz with the singing-flame, it seemed to him that the same principle might be used in voice reproduction. The singing-flame experiment, long known to physicists, was the one wherein a lighted gas-jet was made to vibrate in response to the voice. Protected by a tube, the flame, when a voice spoke at the other end of the tube, rose and fell according to the wave lengths of the sounds. Photographs taken from a revolving mirror showed the differing positions and character of the waves corresponding to the varying words.

How to make use of the sound waves generated by the voice in speaking or singing, and to register them upon the film, was the problem to the solution of which Reis set himself. The sensitized wax plate he discarded as impractical and devoted himself to furthering of the possibilities of flame reproduction.

Setting up an arc-light in a protected chamber, he found that it was as sensitive as Tyndall and Helmholtz's gas-jets had been. Further experiments showed that the electric arc could be made to

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vibrate in response to the wave lengths of the voice. The same principle as found in the telephone was employed, for it must be remembered that the actual voice does not travel over the telephone wire, but only the electrical undulations set up in the circuit by the action of the transmitter. In speaking, the voice with its varying wave lengths strikes the sensitive diaphragm inside the mouthpiece of the transmitter, which, by positive and negative pressure contact on the carbon terminals, transforms the original sound vibrations into corresponding electrical vibrations. The latter are carried over the connecting wire to a small magnet behind another sensitive disk located inside the ear-piece of the receiving telephone. The incoming vibrations arouse the same characteristic wave lengths as were spoken into the distant transmitter, with the result that the voice is reproduced in the ear of the auditor.

This same principle was used by Reis in making the flame of the arc vibrate. Wave lengths of the human voice and of musical instruments were transmitted to the arc by microphone in such manner that the intensity of the light was varied in proportion to the variation and character of the sound waves. These fluctuating light waves were photographically transferred to the film synchronously with its exposure at a point to one side of the pictures, the intensity of the sound being represented, not by peaks of successive heights as in the manometric flame, but by high lights and shadows of varying density.

On the negative as made by Reis appears a

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narrow line something like the line on a player-piano roll, with the exception that it is made up of differing wave lengths and is confined to the side of the film near the sprocket perforations instead of taking its way through the middle course. This line, representing the voice of the speaker, is taken on the negative at the time of the filming of the play and is photographically produced on the film by exposing the rapid vibrations in the luminosity of the arc-light to that portion of the passing film. The character and intensity of the flame, and consequently that of the record of the negative film, vary with the wave lengths of the sound vibrations that make up the words. For one sound the wave is high; for another it is low.

After the negative containing the combined picture and sound record is developed, any desired number of prints may be made by the usual process. As the Reis process leaves the film free from all indentations and requires no stylus or needle either for recording or for reproducing, the life of the film is equal to that of the silent films. The sound is recorded and reproduced with the full purity of the original, due to the fact that a frictionless beam of light is substituted for the needle both in the making and in the reproducing of the record.

The matter of projection is accomplished by means of the accepted intermittent motion and usual lighting arrangement, with the addition of a special arc for the word line. Although a part of the same projection equipment, it is separate in construction and independent in service. The pictures are projected as usual by intermittent

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motion, but the sound is reproduced from a point of the film having a continuous movement. As may be seen, if the two wave lengths were transmitted at the same time, the speakers on the screen would not form the words at the moment they were audible to the audience, by reason of the difference in speed of the transmission of sound and light. Sound travels at the rate of 1,125 feet a second, while a ray of light could pass the distance of seven and a half times around the earth at the equator in the same length of time. Thus by projecting the sound waves a fractional part of a second before the corresponding frames showing the picture, the two come to the attention of the audience at practically the same instant.

The sound volume is ordinarily given to the audience from the rear of the screen, as in the instance of the revolving gramophone disks. It is conveyed there by electrical wires from the projection-booth and disseminated by means of loud-speaking telephones provided with magnifying-horns. Several horns are used so that the sound may issue from directly behind the person who seems to be speaking. This is better to carry the illusion to those immediately in front of the screen, for persons so situated have a sense of direction not so perceptible to those seated at a greater distance from the screen. The sound is conveyed to the different horns by means of a switch in the projection-booth manipulated by the operator much in the same manner as the spot-light, so that he has only to watch the different screen positions assumed by the characters to know which horn to

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cut into the circuit. In a scene employing a number of characters, or in a case of a chorus, the sounds are disseminated through all the horns.

The breaking of the film and its rejoining thus affects its reproduction in no way, for the pictures and their accompanying sound record are equally eliminated. The matter of projection is simplified over corresponding earlier machines, for the reason that an elaborate equipment does not have to accompany the film. The equipment may be attached to any standard projector. Theaters not wishing to equip themselves with the additional apparatus may show the film without the talking-attachment.

By means of the Reis device, the voice value is conveyed to an audience at small sacrifice of its original purity, so that audiences in isolated districts may not only see the greatest actors of the day, but also enjoy their individual speech shadings. By its means the enjoyment of grand opera will be general instead of limited to two per cent. of the people in the United States who now attend. In addition, churches now too impoverished to support a pastor or a choir may enjoy sermons prepared in advance by prelates, so that those in attendance on special occasions such as Easter Sunday may not only see an eminent divine in the pulpit before them, but may also hear the words as they fall from his lips and listen to the choir in its rendition of chants and special hymns. In fact, the only function that will have to be performed locally, as the inventor pointed out, will be that of seeing that the collection-plate is still taken on its accustomed rounds.

XV

THE MAKING OF THE ANIMATED CARTOON

WITH the widening view given by the accumulative success of trick films it was seen that other materials than furniture and silverware could be used to give the illusion of motion. Pianos had walked down the street and tables had been made to set themselves without a hand to help them—as far as the audience was concerned. If inanimate objects could be made to assume motion by photographing them in one position, moving them to another and photographing them again, then drawings showing successive phases of action might be made to move by the same principle.

Studying the possibilities of giving a series of drawings the animation of life was Windsor McCay, who completed a set of drawings each showing a slight advance in action, and exposed them in 1910. The series, "Little Nemo," was followed by a film depicting the adventures of a mosquito. On the completion of this "Gertie" appeared, which showed the prehistoric adventures of a dinosaur and the trouble it had when an elephant disrupted its rule. The film shown in vaudeville became well known.

To show five hundred feet of the dinosaur picture necessitated the making of ten thousand separate

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and distinct drawings. One scene in particular showed the Mesozoic creature, disturbed by the attention of the elephant, pick up the pachyderm and hurl him into the air to fall into a lake. For revenge the elephant filled his trunk with water and gave a moment's unpleasantness to the dinosaur. The dinosaur's answer was to drink the lake dry, leaving the elephant floundering in the mud.

The making of each scene required many drawings, for the dinosaur must be shown in hundreds of positions even in such a simple scene as that of throwing the elephant into the lake. Merely to open the dinosaur's mouth meant that all of the dinosaur, the elephant, the lake, the trees, the rocks, everything must be drawn over to show each progressive movement in the process. One picture would show the mouth partly open, which meant the drawing of all the other figures in the scene; another would show the drawing back of the lips; another the first baring of the teeth; another the reach forward of the head and the action thus continued until completed. To show the simple scene of the dinosaur opening his mouth meant a week's work.

Although a year was spent in the making of the film, it was projected in less than ten minutes. Out from the prehistoric cave came the dinosaur, picking his way over crags and stones until he came across an edible tree, which he promptly swallowed. With the drawings shown in rapid succession the action seemed to be as smooth and as natural as if the beast itself had played the rôle before the camera.

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The film aroused wonder on the part of the audience as to how it was done. At first it was looked on by the manufacturers as a novelty which would soon run its course, but soon it was seen that the animated cartoon had a field of its own. Audiences delighted in the whimsicalities possible to the picture cartoon. It was believed that only stories beyond the possibilities of living actors should be undertaken by the animated cartoons, and as a result the plots as revealed by the cartoons were fantastic ones where at least one of the characters sought surcease from sorrow on the moon. The chase, instead of being confined to the streets, as in the first days of the films, now usually ended up on the moon or in a sprint around the rings of Saturn.

With a vision of the possibilities of the animated cartoon drawings before him, J. R. Bray, a newspaper artist, began to make drawings to be used in animated form. At once the amount of work necessary to make five hundred feet of film became apparent. For one person to make enough drawings to show half a reel meant months of work. This could not be sold at a footage high enough to justify the time and labor necessary to make animated cartoons. Animated drawings had been shown in vaudeville, so that their drawing power as a novelty had abated. Studying the field, Bray determined that some shortened and improved process would have to be devised before animated cartoons could be a commercial success. To perfecting such a method he devoted his attention, with the result that the same number of feet of

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film can be made as in the first film, with one fifth the number of drawings.

As first made, the film showed the hand at its work of sketching, while before the audience the lines grew until the resulting figures began to take on life. For the making of such films a motion-picture camera was placed on a suspended platform with the artist sitting below at his sketching-table. Over the head of the artist was arranged a battery of arc-lights so that the drawings would be brilliantly illuminated at the moment of exposure. Responsible for the camera was the photographer, who stood at his platform above, while four feet below him the artist worked. Taking his position, the artist would call out that he was ready, holding his hand in the field of the camera, while the photographer exposed a number of frames showing his hand in motion. As the audience looked they could see the hand moving and the lines forming. As may be seen, if all the movements of the artist were taken it would mean that the picture would take as long in the showing as in the drawing. This would not only be prohibitive from the standpoint of the number of feet of film consumed, but also it meant that the audience would have to stay the length of time it took the artist to complete the cartoon—a matter of weeks. The matter was solved by simple elimination. The hand would begin to draw and then the operator would stop his camera while the artist blocked in, and then at ten-minute intervals made exposures of the drawing as it stood. These were made with the hand of the artist withdrawn so that it would not

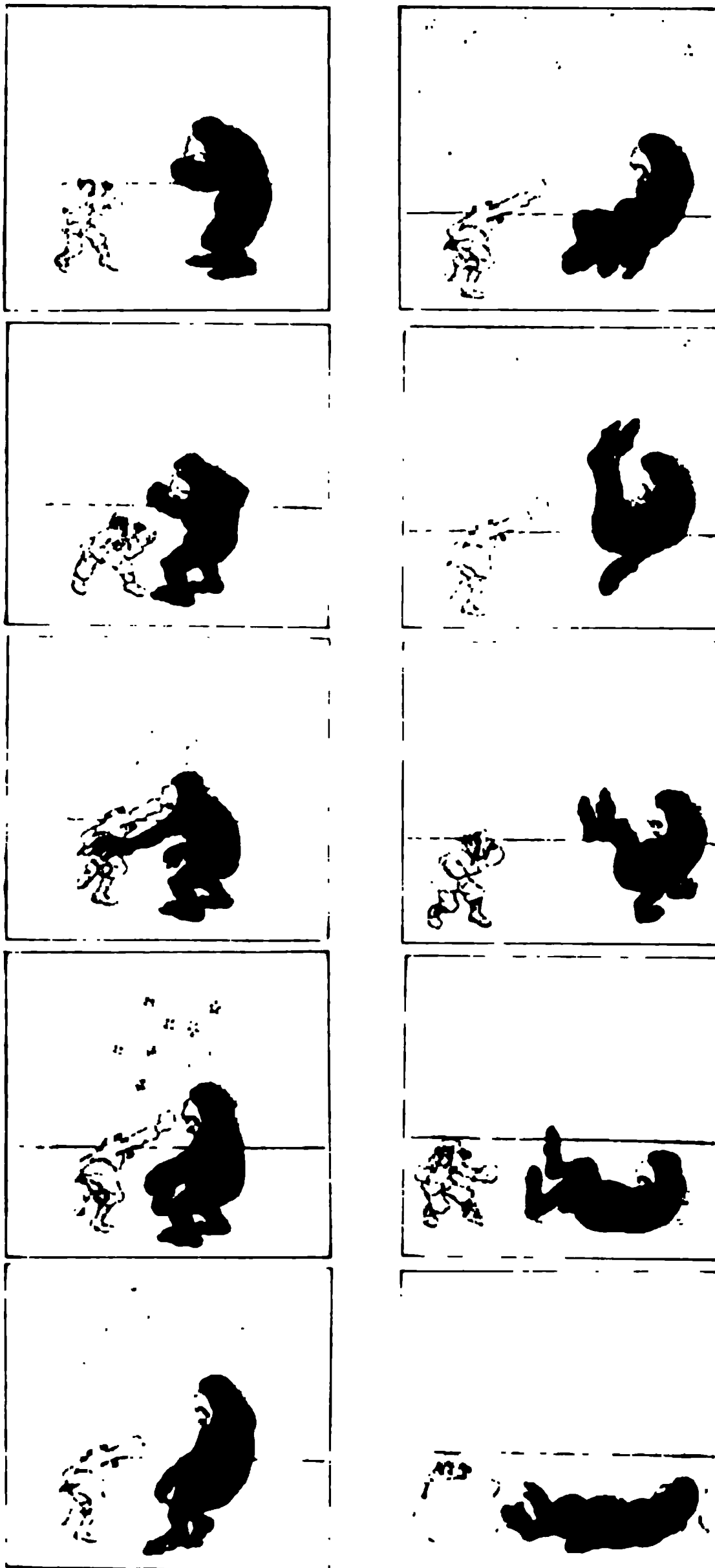
HOW MOTION PICTURES ARE MADE

show on the completed film. Stopping his camera, the artist would make a few more lines and withdraw his hand while the camera man exposed the result. Progress naturally was slow, requiring for a film of any length weeks of work. When the film was exhibited the periods of rest at which the camera stood did not show, so that the drawing seemed to be continuous. Before the eyes of the audience the lines appeared without human agency, much to the mystification of the observers. They did not know that a few lines of drawing would be made, the hand withdrawn, the result exposed, more lines made and exposed in the same way, so that when exhibited the action seemed continuous.

It was seen that some more expeditious method would have to be employed if cartoons were to tell a story in animated form. A number of experimenters set to work to evolve ways and means of facilitating this work, with the greatest success attending the efforts of J. R. Bray and Raoul Barré.

It was seen that instead of having all the drawings on one sheet of paper, as was first done, different poses would have to be put on different sheets of paper. In this way the artist could work in his studio and send the results to a motion-picture shop to be photographed. This eliminated the necessity of having a camera man with the artist as he worked, thus materially cutting down the expense of manufacture.

Even with this improvement the making of a sufficient number of drawings to show five hundred



BY THE BRAY METHOD A TONE VALUE IS GIVEN TO THE DRAWINGS
 To make five hundred feet of animated cartoons requires eighteen hundred drawings,
 each one slightly different from any other.

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feet of film meant prolonged effort, so those immediately interested in animated cartoons began to experiment for ways to shorten their labors. It was seen that in a scene employing several characters the only animation might be on the part of one figure—such a simple movement as lifting a hand—yet all the scene with all the characters in it had to be traced over when the only part that moved was one figure's hand. Experimenting showed that the steady figures with the undisturbed part of the background might be printed, thus eliminating much tracing and thus reducing the cost of the production.

In the drawings herewith reproduced of the fight between Col. Heeza Liar and the gorilla the different positions assumed by the characters may be seen. The ten drawings are used as a base. By exposing No. 1 and then No. 2 and again No. 1 the arm may be made to bend forward in fighting attitude any number of times before it finally strikes out. Each time a drawing is reused it saves just that much effort, so the success of a maker of animated cartoons depends in a great way on his ability to see and eliminate duplications of positions. In the fight a drawing showing one position of the man in the attack may occur again several minutes later. This is used again, saving that much work.

With the coming of shorter methods and improved means came lawsuits and legal complications, for each artist sought to protect his discoveries. But there was little in patent law to give such artists a claim to patent right, for their methods were merely executions of ideas. With

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no machinery employed there was little to substantiate claims for protection.

The use of printed backgrounds was soon abandoned for a much simpler and more practical method—that of using transparent celluloid on which to draw figures wherein there was no movement. This method as originated by Barré and now being employed by all may be understood by an examination into the following drawings from the series depicting the adventures of two characters known to newspaper-readers as Mutt and Jeff. The scene shows Mutt standing on the street near a lamp-post, with the tops of buildings in the background, reaching into his vest pocket to get a match to light his cigar. Naturally there is no animation on part of the lamp-post, so on the celluloid foreground the lamp-post is put. Each successive drawing is photographed through the celluloid so that each frame shows Mutt standing in front of the lamp-post, although there are many Mutts and only one lamp-post. Each drawing shows a slight advance in action. The first shows him with his fingers in his pocket and his foot leaving the ground preparatory to receiving the match. The second and third drawings show the foot brought still higher, while the fourth drawing shows his fingers being withdrawn from his pocket. The action continues until the eighth drawing is reached. The character may be made either to light his cigar with the first stroke of the match or have him make a number of attempts by the simple method of repeating the fifth, sixth, seventh, and eighth drawings. These four drawings repeated

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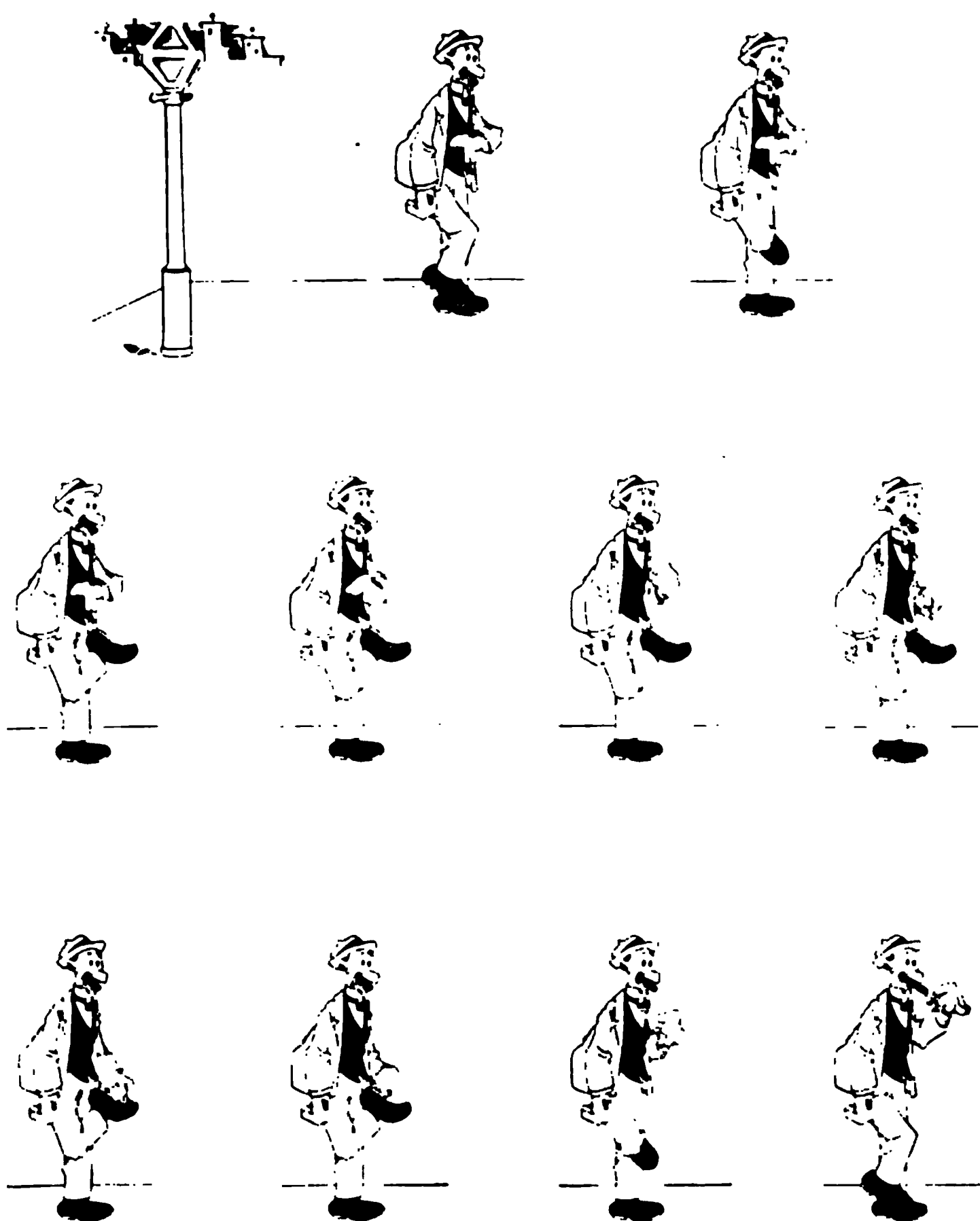
in succession may make the character strike the match as many times as the humor of the situation demands.

In the tenth drawing the match is brought to the cigar and the first flame touches the tobacco. Mutt is standing still, so now a new celluloid showing his feet on the ground is made with the only movement on part of the flame. In number eleven the first bit of smoke is seen, to grow larger in thirteen, fourteen, and fifteen. Further exhalations of smoke with the clouds forming in rings may be produced by repeating the thirteenth, fourteenth, and fifteenth drawings, so that much action may be shown with few drawings.

The number of frames of film exposed to each drawing is determined by the rapidity with which the action moves. Most of the drawings call for an exposure of either two or three frames, depending on the movement, so that the drawings as reproduced on page 317 will remain on the screen in a theater one and one-half seconds.

The amount of work necessary to make an animated cartoon of five hundred feet may be seen when it is remembered that the drawings here shown occupy only one and one-half seconds out of the eight minutes that a half-reel will run.

When additional characters are brought in and a background is used the process becomes more involved. Needless detail is eliminated, so that often in an animated cartoon two characters may be standing talking without a background. This not only helps center attention on the characters, but does away with much work. However, all scenes



**EACH DRAWING IN AN ANIMATED SERIES DEPICTS A SLIGHT ADVANCE
IN ACTION**

Here the comic character Mutt, is shown taking a match from his pocket and
scratching it on the sole of his shoe.

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in an animated story cannot be put on without backgrounds, so different methods have been evolved to furnish backgrounds without the need of having each scene redrawn.

An ingenious way was used for a time to show the procession of objects passing by when a character is on a train and looking out of the window. The point of view of the audience is with the character. As he looks out of the window the audience sees through his eyes. The making of all the objects that pass by would entail many hundreds of drawings. This additional work is eliminated by an ingenious method by which the character is drawn on a sheet of celluloid which is superimposed over another strip of celluloid. On this are drawn the objects immediately in the foreground. Below this is still another sheet of celluloid on which a second line of objects move at a slower rate of speed, and finally in the distance the hills are barely perceptible in their movement. The picture is taken by having the man supposed to be sitting in a train not moving at all. His position remains unchanged, while movement is given to the telephone-poles on the second sheet of celluloid by slowly pulling the strip along under the character. Below this is a third strip of celluloid on which are drawn the fence-posts and objects moving at a slower rate of speed, so that the speed with which the objects seem to be traveling when viewed from a train window may be approximated. The strip with the succession of telephone-poles on it is pulled along at a rate of speed greater than that of the strip containing the distant hills. The

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celluloid, transparent to the camera, shows the drawings under it without obfuscation. As many as twelve strips of celluloid have been photographed through without retardation of the camera's powers. In this way, although the man sitting in the car seat does not move, the illusion of movement is given by the objects being pulled along.

After use the celluloid strips are filed away alphabetically so that if at some future date a story calls for a scene from a car window the strips can be rescued and put into service again without further work on the artist's part.

Advantageous as celluloid strips are in saving the artist work, they have a shortcoming as serious as it is difficult to perceive by the unprofessional eye. Superimposed strips give no perspective, so that as far as art goes the distant hills are as near the train as the telephone-poles—as in Japanese prints. An effort is made to obtain perspective by making the hills correspondingly small, but with no converging lines, as in roads and fences, the effect being not all that could be desired.

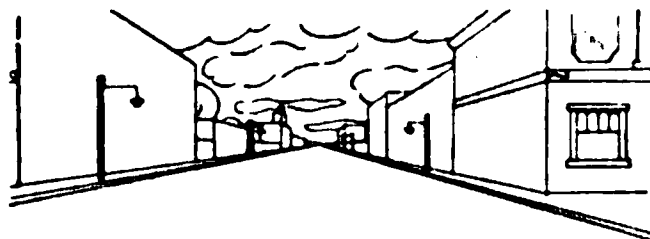
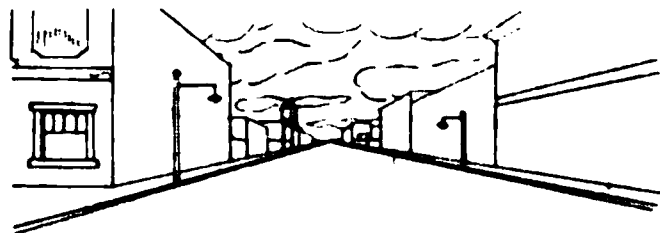
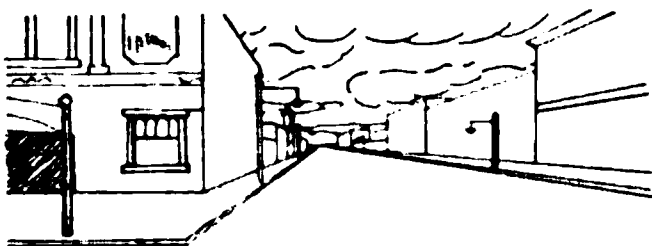
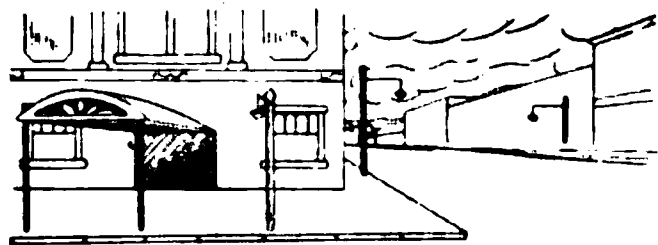
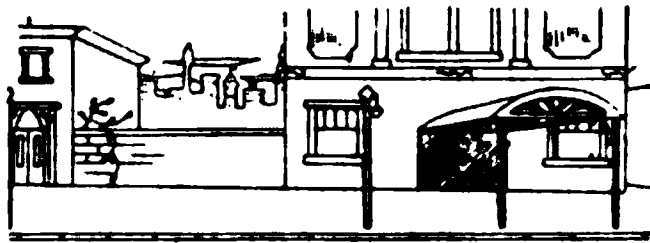
By an invention used in the Barré-Bowers studios, perspective is obtained by an ingenious method by which the point of view changes with the advance of the character. How the effect is brought about is illustrated in the drawings on page 321.

As shown here, the character is walking along a street. By the former method the street scenes would be made on one or more strips of celluloid, pulled along a sixteenth of an inch at a time to give the idea that the character was moving. By the Barré-Bowers method a street scene is devised

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with a slight change in each drawing to correspond to the advance of the character as he progresses down the street, for in no two places does the perspective of a street appear the same to an observer. These drawings are worked out as elaborately as if showing animation on part of the character.

The character is drawn on celluloid in different poses to show the movements of his legs, while underneath the celluloid showing him in action are the street scenes, five of which are herewith reproduced. To show the character walking the length of one block and crossing the street ninety-one drawings are required. The thirty-fifth in number has been chosen as the first one to make evident the change in perspective as the character advances on his way. As seen in No. 35 the hooded entrance is near the right-hand side of the drawing. In No. 46 the entrance has advanced almost to the middle of the drawing, while in No. 59 the right-hand side of the hood is visible. As the character continues his progress down the street, the cross-street comes into view, as shown in No. 70, with his advance across the street again shown in No. 82. In No. 91 he has reached the middle of the street, with the hooded entrance far behind him. Ninety-one drawings have been used to advance the character down the block and half-way across the street. In the making of the picture the character moved only his legs, standing directly still in front of the lens, while the street was made to advance. On completion of this scene the drawings will be filed away for future reference when a street setting is needed.



A CHANGING PERSPECTIVE FOR ANIMATED DRAWINGS

As the character passes along, the street is made to have a changing point of view by means of this patented perspective.

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In addition to selecting scenes that lend themselves to animation without too much detail, the characters chosen to interpret the comedy must not be too elaborate. Each extra line that has to be traced through thousands of drawings each week means serious added expense by the end of the year. Such an incident was the experience of R. L. Goldberg, the cartoonist, who had undertaken to animate his series of drawings known as the "Boob Family." In the series he had two children in comic perambulators, but it was seen that the amount of drawing necessary to show the perambulators in reel after reel would make the series prohibitive in cost, so it was decided to have the children grow up to where they could walk of their own accord. This was done in the rather surprising time of three weeks.

The constant aim is to eliminate all unnecessary detail and to perfect methods of shortening the work, in order to bring down the cost of production to where it will be commercially profitable. Success has attended the efforts to shorten the work, for a five-hundred-foot film that required ten thousand drawings in McCay's day can now be accomplished by combination of tracing paper and celluloid foregrounds with two thousand drawings.

Naturally all the drawings that must be made to show five hundred feet of film in any popular series that appears on a regular release once a week could not be completed by the one originating artist. Working alone it would take him months to complete the release. The work is done by numbers of artists working in one studio on one

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release. The originating artist—the one who conceives the characters for the newspapers—gives no attention to the animation, often not seeing the subject until its projection in a theater.

The artist whose name appears as author of a series rarely makes a single one of the drawings. The work is done by a staff whose names are unknown to the public. In such a series as Mutt and Jeff thirty artists are required to make each week the requisite footage.

When the plot of the story is made up and the scenes determined on which are to depict the escapades of the two amiable adventurers, the scenes are given out to the different workmen. One may make a scene depicting their adventures at a boot-black stand; another artist may carry them through a scene wherein their purposes cross with those of a goat; and so on through the twenty-five scenes that usually constitute a half-reel. The work is not done with the aid of north lights as in accepted art, but at tables with a glass insert under each of which is an electric light to obtain transparency for the lines of the drawing. By this tracing is made easier, for much of the work is tracing, as the animation from posture to posture varies but little. Much of the tracing is done by girls, but for the animation where new and humorous poses must be shown, the masculine sense of humor has been found more satisfactory.

When the two thousand drawings have been completed an exposure-sheet is made showing just how many exposures should be given to each drawing. The drawings are numbered with the num-

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bers in successive order showing on the exposure-sheet. This, with the drawings, is given to the photographer, who places the drawings on a table over which a camera is suspended. The drawings are held in position by pins slipping into two holes at the top of the drawings invented by Barré. This insures the registering of the drawings. By referring to his exposure-sheet the camera man photographs the drawings without further word from the art department and turns the negative over to the printer, who soon has a positive ready for showing.

By the same means a person desirous of spending the necessary money may see the furniture in his room moving about. Giving a photograph to a maker of animated cartoons, he can have enacted in the library of his home any story that he may wish. From the photograph showing the room with its distribution of furniture, successive drawings are made. A porch-climber is shown entering the room; he crosses the room and, stumbling over the piano stool, picks it up and hurls it out of the window. The story can be advanced with whatever comic elements the owner wishes, all showing happenings life-size in his own home.

As may be imagined, it is all the work of drawings. From the original photograph wash drawings are made, with the invading character drawn to scale. To show a simple scene in a room requires the same porportionate number of drawings as it would if the scene were being done in cartoon form.

The possibilities of animated drawings are not limited to cartoons, for the whole field of educa-

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tion and science is open to them. Where the accepted motion picture stops the animated drawing begins.

The disaster to the Quebec Bridge was shown in animated form, true to scale, by drawings reproduced on motion-picture film. The faults, as determined by the engineers, were brought out in hundreds of drawings so that audiences were able to see more clearly than if present at the time of the disaster the cause of the collapse.

When the *Lusitania* was sunk one of the large film-manufacturing companies released a film showing the sailing of the ship, the attack on the vessel, the inside of the attacking submarine, and the final sinking of the liner, to the mystification of the audience. As, naturally, there was no motion-picture operator at the scene of the catastrophe, more interest was aroused as to how it was done. An explanation is here given for the first time:

One of the film companies covered the sailing of the ship for its news department, little realizing that the film would overnight become the highest-priced film extant. Five hundred feet was made with the intention of releasing a hundred feet of the best through the regular news channels. With the word of the sinking of the ship, and when it was found that this was practically all the film covering the sailing of the ship, the commercial value of the negative became apparent. Preparations were being made to release the five hundred feet of the sailing as a special release on account of the unusual interest in the event when word was received from Atlanta that a firm making com-

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mercial films for local advertising and business men had for sale film showing the actual sinking of the ship. Word was despatched to the manager of the firm's Atlanta exchange office to see the film and report. His report was favorable and in a few days the company had on the market a film showing the torpedo being launched from the German submarine, its contact with the sides of the *Lusitania*, and the sinking of the ship.

The film was made in the Atlanta firm's studio. The outline of the *Lusitania* was made in beaver board, similar to a child's cut-out toy, and then carefully painted by a professional scene-painter. The cut-out, eight feet long, was placed in a tank forty feet long in the studio's back yard made to look like sea and sky by painted canvas, which, when tipped at different angles, would show the vessel in distress. The cut-out was pulled through the water by an operator standing behind the vessel and by boards fastened to the bow and stern and manipulated under the water. To give the appearance of the bow cutting the water with waves rolling from it as the vessel sailed along, a small garden hose was fastened to the ship on the far side out of range of the camera, and water sent through it while the vessel was moved along by means of the hidden sticks. Inch by inch the vessel was pulled down into the water to show the sinking, while the scenic background was manipulated to make vivid the rocking of the boat.

The interior of the submarine was similarly made to scale on beaver board from the descriptive passages of books of reference. In the same way the

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torpedo was launched. With the camera at a distance of twenty feet the ship seemed to be life-size. The whole scene was so lifelike that none in the audience knew how it was made. One thousand feet was made showing the sinking of the vessel. Placed together with the motion pictures of the ship leaving the docks, with people coming and going on the decks, the film attracted wide attention, with much wonderment on part of the audience as to how it was accomplished.

XVI

MOTION PICTURES AT THE BOTTOM OF THE OCEAN

THE motion picture had entered the field of the drama, had set itself to the gathering of news, had shown the wonders of growing plants, had analyzed the blood, and by microphotography had reproduced animalcular activities beyond the reach of the human eye, yet three-fourths of the world was still before it, unexplored. It had not yet gone beneath the sea.

Pictures purporting to be taken beneath the waves had been exhibited, as in the instance of the mermaid who had enjoyed a banana at the bottom of the ocean, but which had been a matter of double exposure. In reality the greatest depths yet attained by the motion-picture camera had been those of a glass tank. By selecting the flora and fauna with care and by bringing the camera up close to the tank and photographing through its transparent sides, audiences had been led to believe that they were beholding the mysteries of the ocean's depths when, had they but known it, their applause had been for the necessarily circumscribed area of a studio tank.

Snakes, confined to the depths of a tank, had been made to battle with beetles while the camera

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recorded the conflict, and exhibited on the screen as being one of the daily tragedies of the ocean's depth, but the unequal battle had been fought on a studio platform under the illumination of a battery of arc-lights. Amusingly enough, after it was all over, the ocean had been removed by the stage-hands.

No more ambitious effort had been made to explore the ocean's depths until a young photographer in Norfolk, Virginia, chanced to be coming back on his afternoon assignment when the fading light falling into the streets set free in his mind a vision of Atlantis. The side of a building, seen in the evening's haze, was a fortress under the sea. Much had he read of the Atlantic's sunken continent and long had it fired his youthful imagination. With the light bringing out the characters on the street and with the buildings outlined like ships, the idea came to him to photograph the lost land. With his camera over his shoulder, he returned to the office of *The Virginian-Pilot* and to his dark room, but his interest was at the bottom of the ocean.

From this tiny thought a new world was opened up, for it was left to J. Ernest Williamson to be the first to show photographically the wonders of the ocean bottom.

To his father, Capt. Charles Williamson, inventor of the submarine tube, he confided his plan. Years before, his father had been stirred to inventive effort by a threatened catastrophe off Cape Horn. The vessel on which the elder Williamson, fresh from the ship-building yards of Glasgow,

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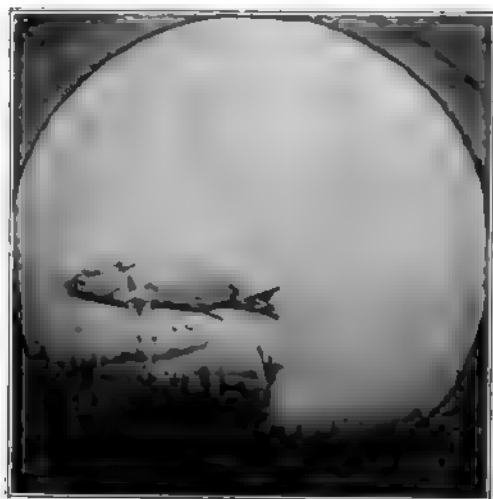
had cast his lot was slowly logging with water. The storm had strained the ship's side beams until water was coming in with every roll to such an extent that loss of the ship could be prevented only by immediate action. The situation was saved by the Scotch navigator bringing out canvas and putting impromptu tailors to fashioning a long sack fitted at the lower end with a rough suit. Down this Williamson went, the passage being kept open by iron hoops, his hands in the sleeves, and with his activities guided through the tube's glass front he calked up the seams sufficiently to bring the vessel through the storm, when the task was completed with more thoroughness and less exposure.

With this Williamson began to dream of a long bag with a chamber that would permit passage to the bottom of the ocean, for the purpose of either salvage or observation. Into concrete form, after adventuring in strange waters, he put his ideas and cast his lot at Norfolk, Virginia, where two sons, Ernest and George, came to stir him on to renewed activities. From the canvas bag, as first used off Cape Horn, the present Williamson submarine tube grew by which an observer may go under water to a depth of five hundred feet to make observations, breathing free air. The tube hangs beneath the supporting vessel, swaying and bending with the tide or with the movements of the vessel. This movement is made possible by the stretching apart and return of the flexible metallic walls of the tube between the successive iron rings, after the manner of an accordion, imparting the necessary flexibility. Without this mobility the

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invention would be useless, for a rigid tube dragged through the sea by a supporting vessel would soon be torn away by the leverage of the opposing mass of water.

Collapsible flexibility is assured by overlapping protective scales, with the shaft kept open by iron



THE FIRST PICTURE EVER TAKEN UNDER THE OCEAN

It was made in Hampton Roads and shows "croakers" swimming on the bottom. From this still photograph motion pictures under the water were developed.

rings of sufficient strength to resist the pressure of the water. The rings act as a ladder conveying one from top to bottom, while the open passage obviates the necessity of forced air.

Approached by his son, Captain Williamson gave the use of his submersible tube, little dreaming that more than a family interest would ever be attached to the experiments. Enlisting the services of his brother George J. Ernest Williamson went to the

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barge *Ada* in Hampton Roads, descended the tube, and placed his camera against the tube's glass face, ready to record the ocean's mystery. His dream received a quick awakening, for he discovered that the Norfolk waters were so murky as to obfuscate all marine life. Promptly he set himself to arranging illumination, accomplishing this by lowering a bank of electric lights directly in front of the observation window. Attracted by the strange visitant, the harbor fish swarmed around the lights, making possible the first picture ever taken at the bottom of the ocean. It was of two croakers, swimming in opposite directions, and is herewith reproduced. Their name is derived, as may be imagined, from a peculiar grunting emitted by them on first being taken out of their native element. Thus on June 18, 1913, the first submarine photograph was made from which was to spring undersea motion-picture photography.

At approximately the same time, Z. H. Pritchard, an English artist, had gone about to reproduce the ocean's wonders in an entirely different way. Forced to leave England on account of his health, he had gone to Tahiti, where, with long hours to while away, he had on the seashore sketched the crawling creatures and growths just beyond his reach. Attracted by the glories still deeper, he had dived down, looked, and come back to reproduce what he had seen. But the brilliancy of their colors he could not carry, so for himself he made a pair of water-proof goggles and secured some water-proof pigments. With the aid of a diving-suit he could sit for an hour among the wonders he wished

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to reproduce, returning at the end of that time for air and rest. Striking as were the effects that he secured, his method of reproduction was not fitted for an age that demands wide distribution,



SHOWING HOW "TWENTY THOUSAND LEAGUES UNDER THE SEA"
WAS MADE

The photographer passes down the steel tube to the enlarged bell, while electric lights illuminate the water sufficiently for exposure of the film.

so to J. Ernest Williamson with his camera was left the honor of giving to the world in reproduced form the wonders of the ocean's bottom.

From Norfolk the news was sent out that Williamson had succeeded in making photographs at the bottom of the ocean, with appropriate headlines in the New York papers and colored pages in the Sunday sections. Monday's mail was heavy

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with letters, and among the telegrams on his desk was one that secured his instant attention. It was from a motion-picture manufacturer asking if he would undertake a contract to make motion-picture scenes on the ocean bed. Instantly the possibilities of his discovery stood before him, with an immediate answer on his part that he would, when his claim to undersea motion-picture photography lay in a few inanimate photographs of croakers. With his acceptance of the offer he began to ponder, with pardonable interest, as to how he was going to carry it out.

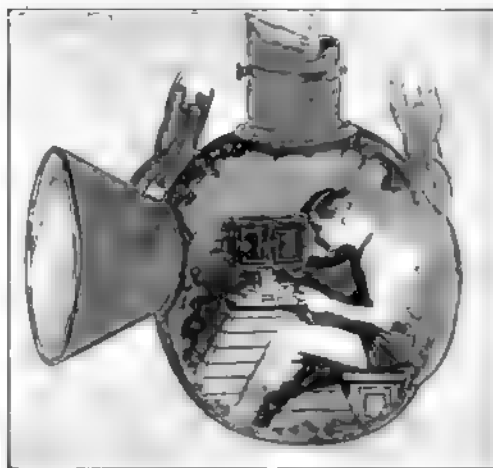
To the management of *The Virginian-Pilot* he went and handed in his resignation, explaining that other fields of activity were calling him and that he had contracted with the great managers of New York to do exclusive and demanding work for them, omitting to mention just how he would carry out his part of the contract. He was now a submarine motion-picture photographer—with a few pictures of croakers to prove it.

A survey of the field convinced him that Hampton Roads was not the place to attempt undersea photography, by reason of its murkiness. Accordingly he made working arrangements with his father for the use of his submarine tube, and went to the West Indies and constructed a barge and set to work converting it into the first motion-picture deep-sea photographic experiment boat. As he had anticipated, there was abundant illumination offered by the tropical sun, which illuminated the water sufficiently for photography to a depth of ten feet. Choosing a white sandy bottom

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that gave back a reflection, he was able to simplify his attempts.

From the center of the barge the steel neck was let down with a chamber at the bottom for the accommodation of the photographer, with a circular glass plate set into the front to allow of a greater



THE PHOTOGRAPHER SITTING IN THE ENLARGED BELL AT THE BOTTOM OF THE DIVING-TUBE HAS AN OPEN COLUMN OF AIR ABOVE HIM

The pictures are taken at a depth of thirty feet.

sweep for the camera. Daily experiments were made to determine the matter of equalization of air pressure in the tube with the water pressure outside, the kind and proper placing of the lights, and all the minutiae necessary for the performing of a feat attempted for the first time.

Motion pictures were made of the preparation, showing the construction of the tube and chamber with the experimental descents, depicting not only the apparatus, but also how the diving was to be

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accomplished. Pictures were taken showing the divers being lowered in the suits, with natives keeping the air-pumps in operation.

After the surface preparations had been filmed pictures were taken of the native boys diving for pennies tossed into the water by onlookers, showing how they followed the coins to the bottom with their eyes open and, seizing them, conveyed them to the top and to the safekeeping of their mouths, constituting the first motion pictures ever taken of human beings under water.

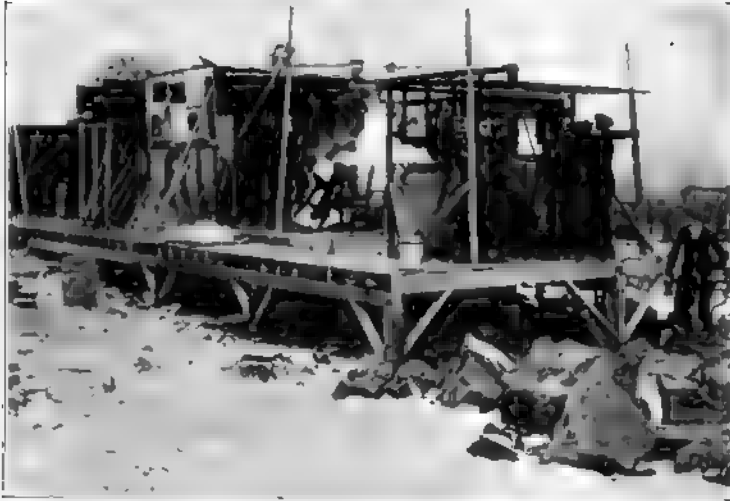
With shore preparations completed, the barge lifted anchor and steamed out to Watling's Island, where, appropriately enough, Columbus had made his first adventures into an unknown land. There the bell was lowered and down through the diving-tube Carl L. Gregory descended and made the first motion pictures of the flora and marine life at the bottom of the ocean. Bending in the undertow, as reeds to the wind, were fans, coral whips, and growths unknown to oceanographers, with fish coming and going over the sponges and the wrecks of old ships never before known to marine observers.

After three months of exploring the pictures, showing the start of the expedition from New York Harbor, with the descent of the governor of the Bahamas and his wife to the bottom of the ocean through the tube, were put together in connected form and released under the title of "The Williamson Submarine Expedition."

The success of the film was such as to make the owners eager to return on another expedition and show further marine wonders. It was seen

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that to make the film more appealing the marine views should be given to audiences not as scientific pictures, but in story form. Accordingly a contract was entered into with the Universal Film



THE "NAUTILUS" ON FIRE

The water scenes were made in the Bahamas, while the studio scenes were made in New Jersey.

Company for the filming of Jules Verne's *Twenty Thousand Leagues Under the Sea*, the undersea parts to be done by the Williamson brothers, the studio sets to be left to the Universal.

From New York a director and cast were started for Nassau Harbor to make the requisite scenes, while the Williamsons were still busily engaged in solving problems. Word had come from London that a British diving-suit just on the market made unnecessary a connecting rope and rubber tube. By it the oxygen was supplied by a generating

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apparatus carried on the back of the diver, the resulting freedom permitting him to go into places inaccessible when hampered by a connecting tube. A cable was despatched to London and the suits ordered, but when they arrived it was found that none of the West Indies divers knew how they were worn. A search was instituted, word finally reaching the brothers that there was a diver in Yucatan who was equal to their demands. He was cabled and funds despatched, but when he arrived and made a preparatory descent it required the combined efforts of two doctors to resuscitate him. He soon resigned, explaining that unexpected conditions had arisen that made it necessary for him to return to Yucatan at once.

Word was despatched to New York not to let the director and cast sail, but they were already on the way. Quick cabling resulted in discovering one man who had experience with the British suits. He was in the government diving service at the Brooklyn Navy-yard, but a few exchanges of messages convinced him that his future lay as an independent diver rather than in government service. His resignation was accordingly handed in and preparations were made to sail for Bermuda, when a cable came that the *F-4* had sunk in three hundred feet of water in Honolulu. Six hours later the diver, by government order, was headed westward instead of south, one of the crew of the rescuing party. While working with the sunken craft, he established the world's record, going down and putting lines under the *F-4* at a depth of three hundred and four feet.

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Into the breach Williamson himself stepped, putting on the diving-armor and personally making the preparatory tests. Other divers he taught, so



J. ERNEST WILLIAMSON READY TO MAKE A DESCENT FOR THE MAKING OF THE FIRST MOTION PICTURES ON THE BOTTOM OF THE OCEAN

The Bahamas were chosen for the making of the pictures by reason of the clear white sand on the ocean bed and for the brilliant surface illumination of the southern sun.

that he soon had a crew of six trained to meet the demands of the British suits.

A submarine was constructed, which in the picture was to be Captain Nemo's, and the picture proceeded. A cast was used for the studio scenes, with the trained divers substituted for the under-water parts.

With the barge fully equipped, the boat was taken outside Nassau Harbor and the tube and its chamber lowered to the bright bed of the ocean. Two lenses for the observation bed, each five feet

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in diameter and an inch and a half in thickness, had been ground in France for the expedition. To equalize the pressure and to keep the glass fronts from being crushed in by the weight of the water, a counter pressure was set up in the bell to offset that of the water. From the depth of thirty feet the first observations were made. The clarity of the water permitted vision to the distance of one hundred and fifty feet. Turning his eyes upward, the photographer could see the surface waves breaking up the shafts of sunlight into a beautiful shimmer of silver.

On their backs the divers, doubling for the actors, carried their supply of oxygen and on their feet leaden shoes which, on being released, permitted the submarine explorers to rise rapidly to the surface. To lend additional dramatic value to the story, the divers carried guns with which to safeguard themselves from enemies and spears with which to defend themselves in case of physical attack. Naturally, explosive rifles could not be used, as a moment's thought on the part of the audience would uncover their fallacy, so compressed-air guns were employed, discharging a burst of bubble with sufficient realism to bring applause from the most apathetic.

Curiously enough the British diving-suits were found, when the pictures were shown to an audience, not to afford the thrill that their users had expected. Accustomed as people were to seeing a person go down into the water only when connected with the surface by means of an oxygen-tube and life-line, audiences were not proportion-



**THE FIRST EMPLOYMENT OF SELF-CONTAINED DIVING-SUITS IN THE MAKING
OF SUBAQUATIC MOTION PICTURES**

No tube connected the diver with the upper air. The divers were kept on the ocean bed by means of heavy leaden shoes. The divers are here shown coming down from the trap-door of Captain Nemo's ship.

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ately responsive to divers coming and going in the water with only the restriction of diving-suit and leaden shoes. They wanted to see an air-tube and bubbles rising, and so in later submarine pictures audiences were given what they wanted, illustrating once more that people loved to be deceived.

It was decided that a moving picture of a man fighting a shark at the bottom of the ocean would give audiences the necessary thrill, and accordingly preparations were made to film such a picture. But unexpected difficulties arose.

An advertisement was inserted in the local papers on May 4th, offering to buy a dead horse to be used as bait, but to it there was no response. Again the offer was made, but without answer. The space in the paper was continued, while an agent went out to find a horse suitable for the purpose in mind, or one that seemed on the point of giving up an active life, but the agent's activities were productive of nothing. Finally on May 30th a horse, well advanced in years and handicapped by various spavins and fistulas, was bought and released from his misery. Towing the carcass behind the barge, the party left the quiet waters of Nassau Harbor and struck out for the edge of the ocean where sharks were known to exist. The animal was lowered and the photographic tube made ready, while on the deck, stripped to his waist and his body covered with oil, stood Buller, the giant Bermudian who, diving into the water with a knife between his teeth, killed sharks single-handed. The sharks were to be attracted by the bait, word was to be given to Buller, who was to leap into the



TUBE AND AIR-BUBBLES USED LATER TO MAKE PICTURES MORE REALISTIC
The diver is here shown struggling against the undertow.

HOW MOTION PICTURES ARE MADE

water and despatch the shark in range of the camera. Buller had a record of diving free hand to a depth of eighty feet and was known to be fearless even in the presence of the most formidable hammerhead.

Scarcely fifteen minutes had the bait been displayed until a shadowy form was seen coming slowly toward the animal carefully moored within the angle of the camera. At best this was only twenty degrees, hardly wider than that of a wedge of pie.

The creature stopped and hung motionless in the water with its head pointed toward the bait, and then slowly circled the barge, its blue back and white belly shimmering in the clear tropical water. Then as silently and as mysteriously as it had come it disappeared, to be gone for half an hour, when it returned with another. As slowly as the first these two circled the bait and, as the first one had done, silently disappeared. An hour later they returned with two more, soon to be joined by others until a dozen lean, silent creatures were floating within a few yards of the bait, heads in, their small cruel eyes plainly visible to the anxious faces peering over the rail of the ship. All day the creatures waited, while the photographer sat cramped in the bell and Buller stood crouched on the deck with his knife between his teeth. But no effort did the creatures make to avail themselves of the bait. Nor did they the second day, and despairingly the crew went back the third day. Eleven o'clock came and the creatures still floated silently out of range of the camera, and then, with a rush, they bore down on the bait without circling or pre-

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paratory warning. Plainly could be heard the crunch of their jaws, while their tails flashed in and out in competitive frenzy.

Word was called down the tube for the photographer to be ready; Buller rose up with the long knife between his teeth, his oiled body glistening, and shot into the water with hardly a splash. Pick-



FIGHT BETWEEN A MAN AND A SHARK IN THE OCEAN DEPTHS

For defense the diver has only a knife. A dead horse was used to bring the shark near enough to the motion-picture camera to show on the film.

ing out the largest shark, he made straight for it, deflected his course, and, coming up under its white body, struck out with the thick-bladed knife. A line of red ran along the glistening white, while the creature struck with its tail and doubled back. Buller, on the alert, dodged. The water began to turn red and the threshing of the creature to abate. Slowly it began to sink, while Buller turned upward.

Eagerly they called down the tube to ask the photographer if he had got the fight. His answer

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was what they dreaded. The conflict had been outside the angle of his camera. All the days of preparation and waiting had availed them nothing.

Inquiry from the expert shark-fighters aboard made plain that the sharks would stay but a few minutes longer by reason of the death of one of their number. Action must be immediate. Stripping off his clothes and smearing his body with porpoise oil, J. Ernest Williamson, always an expert swimmer, leaped into the water. He, better than any one else, knew the angle of the camera, and with his eye on the glass front of the diving-bell made for a shark within range. As he had seen Buller do, he dived under it and struck upward. His aim went true and, protecting himself from the lashes of the shark's tail, he turned for the surface. An eager call down the tube to the photographer revealed the fact that the fight had been in the desired angle and that the story was now recorded. The big moment of the play had been achieved.

Study of the story convinced them that the under-sea scenes were the ones that would make the film, not alone on account of their novelty, but by reason of their dramatic value, so it was decided to add another submarine feature. The most daring thing that presented itself was that of a fight between a human being and an octopus. This seemed to promise everything that could be desired in the way of aquatic thrills, as the scene wherein a man should be slowly drawn into the tentacles of a huge octopus had undoubted dramatic possibilities.

The dramatic situation, however, received a setback when it was discovered that the biggest octo-

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pus along the Atlantic coast measured only six feet from tentacle tip to tentacle tip. It was not conceivable, even under the wizardry of motion pictures, that a man could convince an audience that his struggle was an uneven one when he could



BULLER, THE NATIVE DIVER WHO FOUGHT WITH THE OCTOPUS IN THE OCEAN SLIME

pick the enemy up and carry it off under his arm. But when the picture was shown on the screen it disclosed an octopus before the eyes of the audience that answered every requirement in the way of size. In fact, the octopus was thirty-two feet across.

The octopus was viewed by millions and from

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them elicited only surprise and wonder, few of whom ever doubted but what the marine giant before them was an actual dweller at the bottom of the sea. The real nature of the octopus was long a secret, being revealed for the first time in a lawsuit between Ernest Williamson and the Universal Film Company, when it was made known on the witness-stand that the creature that had aroused the terror and suspense of so many thousands was only a laboratory product. Its composition was only that of canvas, rubber, and springs, all carefully manipulated by workers inside the body of the giant cephalopod. The scene was rehearsed and all seemed to go well, but at the filming the diver became entangled in the wires so that, struggle as he might, he could not liberate himself. Although a trained diver and accustomed to staying under water an unusual length of time, he began to show signs of distress. There was no other trained diver at hand to send to his rescue and for several moments it looked as if he had encountered his last octopus. At last he succeeded in freeing himself. The camera man had kept on cranking, with the result that the struggle was given a realistic touch that was undeniable.

In the manufacture of the octopus it was found that the making of the tentacles gave the greatest trouble, so instead of putting out an octopus with eight tenacles close observers of the film were surprised to find that this new giant of the sea had only six arms. Otherwise the creature was made so accurately to scale and so true to life that accustomed observers of marine life passed it by without

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criticism. Such observers little suspected that inside the body three men were busily engaged in pulling wires and hauling ropes to manipulate the six long and fearsome tentacles.

The experiments in the taking of this story, as conducted under the twenty-four-hundred candle-



A FUNERAL (FOR MOTION-PICTURE PURPOSES) ON THE BOTTOM OF THE OCEAN

Figures walking in the water at a distance of seventy-five feet will show on the completed film

power quartz-burner Cooper-Hewitt lamps, showed that pictures could be taken with objects seventy-five feet away and that they would be clearly defined in the film. Although the pictures could not have been taken at a greater depth, the marine gardens and scenes necessary were found at thirty feet with a reflective white bottom underneath. Pictures taken at too great a depth hamper the action of the divers by reason of the weight of the

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water, but by lowering appropriate lights and an electrically operated camera, the human element is eliminated with the cinematographic possibilities unlimited. In fact, some day motion pictures may be exhibited of the wreck of the *Titanic*.

That such a plan is contemplated is made all the more remarkable when it is remembered that it was only in June, 1913, that a young photographer passing down the streets of Norfolk dreamed of the lost cities of Atlantis and now the filming of the world's greatest tragedy is before us.

XVII

THE FUTURE OF MOTION PICTURES

IN twenty years the motion picture rose from the last turn on the program, where its purpose was not so much to attract audiences as to dismiss them, to the fifth industry of the world. Now that it has reached this position it is well to stop and examine whether its future shall be progressive or retrogressive.

It is well to ask on what the people who now attend motion-picture exhibitions depended for their entertainment before the advent of the cinematographic art. They were just as eager to be amused, just as anxious to be lifted out of their rounds, just as interested in the imaginary adventures of others as now. The answer is that they depended on reading and the magazines for their relaxation and glimpses of life. The lighting of the evening lamp was a signal for bringing out books and magazines, but now there is little demand for the evening lamp. At about the time it is to be lighted the younger members of the family now hurry to the motion-picture theater to suffer the trials and tribulations of their favorite screen star and to rejoice in the last act at his or her triumph over the forces of evil.

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The transfer of interest from books and magazines to interpreted action has resulted in a steady decrease in the circulation of the magazines. The first publications to feel the inroads of the motion-picture interests were the monthly magazines which depended for their interest on short stories and serials offered their readers once a month. With the advent of the motion picture, audiences lost interest in monthly serials, as the demand for fiction and adventure was supplied by the theater at a price less than the cost of a magazine. Steadily the sales of the monthly magazine, whose interest was dependent on fiction and literary miscellany, dropped off. Such magazines cut down in quality of paper, in number of pages, or added to the price to meet the new financial requirements. As the competition became keener many of the monthlies either discontinued or narrowed their interests. Instead of trying to appeal to a general public they made up their contents in such a way as to attract a restricted class of readers, but to attract them more vitally than they had their general readers. Magazines of once popular appeal became magazines for owners of country homes, for owners of motor-cars, or for those interested in the discursive side of the day's questions.

With the loosening of the hold of the popular-fiction monthly, the weekly publications came more and more into the lives of the people. The monthly was not before them often enough to hold their attention. But even now the weekly, with a few notable exceptions, is waging a losing fight with the motion pictures. Shortly will be seen a decrease

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in the power and influence of the weekly, with a gradual shifting of the conflict to the daily newspaper. It will make a longer and more equal struggle by reason of its local interest. But even its interest will wane in favor of that of the motion picture, which arouses an enthusiasm unapproached by even the best of daily papers.

However, the only change will not be that of interest shifting from the printed page to the motion picture. Motion pictures will soon no longer be confined to a few paid places of admission, but will be part of the equipment of every church, club, and social organization, whether its purpose is social or instructional.

The magazines most in demand in the libraries to-day are not the magazines devoted to fiction, as might be expected, but the magazines devoted to the plays and players of the motion picture. An examination of the cards shows that the magazines now called for oftenest are those showing pictures and retailing information about film stars. With these magazines the public acquaints itself with the minutest activities of film favorites, even to the name of the star's favorite lap-dog, until a member of the younger generation is now a walking encyclopedia of useless information about the whims and fancies of the screen players.

No more difficult field could be found in which to cast a horoscope than that of the motion picture. This is due to the constant change and continual shifting of this newest of the world's industries. Its wonders of yesterday are accepted to-day without comment. So fast is it growing and so kalei-

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doscopic are its changes that only a brave heart would dare to predict its course. But even in spite of its volatility, to the close student of motion pictures certain well-defined lines of advance are to be seen.

Dramatically motion pictures will scarcely rise to higher heights than now attained. The finer shades of feeling and temperament are now conveyed to the screen in sincerity equal to the best in the older form of art. The vague, futile lifting of a hand now conveys as much in motion pictures as it does on the stage. In fact, by lighting and by means of close-ups attention may be called to finer movements and more subtle expressions in motion pictures than is possible to an audience watching a dramatic interpreter in the flesh. The lifting of a brow in motion pictures, as brought out in a close-up, is apparent in its magnification to every person in the audience, however remote may be his seat, while the same is lost to all save those seated favorably when the actor appears in person. The lens of the camera serving as one all-seeing eye narrows attention to one movement and then enlarges and magnifies it until its meaning is unmistakable. When the director wishes the audience to see only the eyebrow in its interpretative upward movement, the camera is brought nearer and so focused that only the actor's face fills the field. Attention is thus shut out from all other interests. Such is not possible in the spoken drama—however carefully the stage lighting may be managed.

In their own particular medium of expression motion-picture actors are now as skilled as are the

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actors on the stage. The best of motion-picture acting is now comparable to the best of stage acting. The advance in motion pictures will not be in increased skill in histrionic interpretation, but in other fields.

The most marked changes that years succeeding the publication of this volume will bring about will be in further mechanical advancement. More than in any other art the effect is dependent on the excellence of machinery. Painting, sculpture, singing, drawing, writing are direct mediums, but in motion pictures the actor is dependent on the mechanical excellence of some dozen intervening machines. It is in the machinery of presentation that coming years will show the greatest advancement. The acting is now more highly perfected than the machinery.

Lighting effects which are even more vital to motion pictures than to so-called legitimate productions will come to be a constantly increasing factor. Hard lights, soft lights, and lights reflective of moods will be employed with an artistry unknown to-day. With the increase in skill in lighting will come greater artistic effects. The art will swing between broad sweeps of the camera where mountains and armies will be seen to the smallest facial contortion—and each extreme will be done with an increasing skill.

Realism will replace the present tinsel where so many motion pictures seem to be devoted to rich men getting in and getting out of automobiles. At present the trolley-car, so far as may be judged by motion pictures, serves its place in American life by being a comedy vehicle to be run into. A

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working-girl may go to the factory the first day in a trolley-car, but soon she is riding side by side with the manager in the latter's luxurious limousine.

With the passing of time evening clothes will no longer fill audiences with awe. Rather their enthusiasm will be reserved for accurate portrayals of life. The course of realism and naturalism will follow that of the theater where it was made possible by the effectiveness of electrical lighting. But the matter of realism or a continuation of the present exaggerated efforts are mere moods of the moment. Our attention is rather for the permanent and structural changes of the art.

Better cameras, better printing and projecting and mechanical presentation are the natural course of events as more and intensified minds are brought to bear on a problem moderately easy of solution, but it is not in these inner interests of the profession that the greatest change will come about. Nor in the increasingly better plays that will be presented. To an analyst of the art it is but a matter of brief observation that the plays—the stories—in themselves are now the weakest part of cinematographic presentation. Painstaking mechanical detail, from the original drawing of the first set till the picture is presented on Broadway for its critical showing with experienced actors appearing in lavish sets, is wasted on stories whose proper place of presentation is the fourth reader. However, this is a matter of the moment, one which a little prescience on part of the producers can ameliorate. The future of motion pictures will hang on something other than the elimination of the thin story.

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Mechanically the greatest achievement of the coming years will be the perfecting of colored pictures. Working in black and white, even the best of cinematographic art can only approximate nature. With the coming success of chromatic films nature will be rivaled in detail. Scenes will stand forth with as much brilliancy and intimacy of detail as in the original itself.

In the plays of the plains the Indians with their blankets will appear to the audience in the theater as rich in color as if the audience was in the actual presence of the aborigines themselves. As so far developed color has been disappointing, for the reason that it predominates the scene and for the fact that the original must be approximated in either two or four colors. Two colors will be of no future interest; only in the more accurate four colors will pictures be developed. With the perfection of chromatic cinematography the mechanical shortcoming now experienced in distracting pulsations and fringing will be eliminated till the color in motion pictures is comparable to that in printing. But disappointment will at first be experienced by audiences expecting more than chromatic films will give, because the color will not predominate the scene. Looking at the story as it unfolds itself on the screen, the audience will soon forget that it is looking at tone values, just as one walking down the street is unobservant of the color values of different buildings he passes. Only when a flower, a bright dress, or some vivid bit of coloring appears will he be cognizant of color.

Of lesser interest and longer to be achieved will

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be vocal films. Strangely enough, speaking films engaged the attention of inventors long before chromatic films did, and to the early workers speaking films seemed much more needed than colored films, but the coming years will reveal little interest in speaking films. They will be a success from the mechanical point of view, but they will have little dramatic interest. From the standpoint of the box-office colored films will be notably more successful. Color will bring more people to the theater than will audition. The next few years will see the mechanical perfection of talking films, but their ticket-selling capacity will be negligible. In fact, instead of achieving a dramatic triumph they will be a failure. This limitation will not be one of mechanics, but a psychological one.

The first to see the possibilities of speaking films was Thomas A. Edison, whose clear vision immediately fixed on the musical rather than on the dramatic possibilities of a combination of the two machines. "In the year 1887," he said, "the idea occurred to me that it was possible to devise an instrument which should do for the eye what the phonograph does for the ear, and that by a combination of the two all motion and sound could be recorded and recorded simultaneously. The idea, the germ of which came from the little toy called the Zoetrope, and from the work of Muybridge, Marey, and others, has now been accomplished so that every change of physical expression can be recorded and reproduced life-size. I believe that in the coming years, by my own work and that of Muybridge, Marey, and others who will doubt-

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less enter the field, grand opera can be given at the Metropolitan Opera House in New York without any material change from the original—and with artists and musicians long since dead.”

This is the most far-seeing prediction that has ever been made in motion pictures. It has not yet been accomplished, but the coming years will see it a commonplace.

The reason why spoken drama, interpreted in action by motion pictures, will never be a success is an interesting one.

The chief source of interest in motion pictures is the constant stimulation they are the means of furnishing to the brain by the fact that part of the story is left out. The mind is stimulated into interpreting the action of the performers on the screen and applying their motives and anticipating their actions more by the fact that the words are missing than if the words were audible. The observer supplies his own words, in his own language, and after his own manner of thought, as art in its highest form always causes an observer to do. The message it conveys to an American and to a Chinaman is antipodally different, as would be the message of a great painting, and each, conceiving his own interpretation, is satisfied with the part he has taken in the play. With the words unspoken, the observer enters into the play and imagines himself a participator more than if some omniscient machine supplied them. Without the words he is free; he interprets the actions as befits his age, experience, and philosophy. With words his imagination is handicapped rather than stimulated. Dramaturgically,

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the coming years will not find talking-pictures a success. With their presentation in their new and advanced form they will be greeted as a novelty and live the life of a novelty.

Speaking films will shortly be achieved, but their manner of presentation will not be that of the waxed reproducing cylinder juxtaposed behind the screen where the vocalities of the actors are intrusted to a needle traveling in a waxen groove. Instead they will be achieved by reproducing by means of light and electrical contact the voice on the film itself, traveling along with the action of the story in a line roughly similar to that of the pianola player. Their success will not be in the dramatic, but in the educational and musical fields. They will attain their greatest success in scientific work, such as clinical operations where a surgeon performs a difficult operation and, speaking into a reproducing horn, calls attention to the different points of interest which in turn are brought out by the film itself. The film with its vocal record can thus be presented to classes and specially selected bodies remote from the scene of the original operation.

Emphasizing more the vocal side of the film, opera will be presented, as Edison predicted twenty years ago, in small towns and villages where its thrills are now only a remote and far-away dream. Caruso or Galli-Curci in the rich setting of a metropolitan opera will be taken to the now inaccessible points and shown in the original glory of a New York performance by means of motion pictures, while the speaking film will record their triumphs.

No greater change will coming years reveal than

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that to be brought about in the part motion-picture instruction will play in the public schools. Class-rooms fitted with projection-machines will be an accepted part of the school equipment. Fewer and fewer text-books will be found in the schools, with an increasing number of films. History will no longer be taught from books, but from living models. Coming students will see George Washington cross the Delaware from shore to shore. The whole of the American Revolution will be in seven reels and will be presented to the students in a way much more vivid than in its present unrelated generalities.

Not only history, but geography and science will be taught by means of motion pictures. Present-day geography can be shown by means of a trip up the Nile or Amazon with a camera, but more important will be the teaching of the effects of geography on peoples of eras long gone. Moving charts and diagrams will show the flow of a people toward a certain region to be stopped by a mountain range or an arid area. The movements of centuries will be brought out in an hour and will be more vivid and permanent in their lasting effects on the student's mind than the same material covered from text-books in a semester's course.

Science especially will be taught by means of motion pictures traveling on an accepted schedule much after the manner of the present routing of theatrical subjects. A film illustrating the action and reaction of certain gases will be shown in one high school, to be sent from there to another, until it has completed its round of schools of that grade.

HOW MOTION PICTURES ARE MADE

Schools public and private unable to equip themselves with paraphernalia to perform complicated and expensive experiments will have these experiments presented to them in graphic form from laboratories adequately equipped for the work.

As a result of the amount of knowledge that can be imparted in this new form of instruction, school courses will be shortened instead of lengthened, as is now the general practice, so that students may specialize in commercial and vocational subjects. A student who is forced by economic stress to seek employment early will be able by means of motion pictures to get a fairly comprehensive idea of American history and scientific subjects, with some familiarity with Shakespeare, and then devote himself or herself to shorthand or any of the immediately capitalized branches of study.

The subjects and stories thus depicted will be authorized by an educational board that anachronisms may not creep in so that students witnessing the surrender of Yorktown may see its reproduction with historical accuracy. Pictures thus approved will be made by private and specialized concerns, as are the text-books of to-day, and distributed much in the same way.

The history of the Great War will not be taught to coming generations in book form alone, as our past conflicts have been, but will be unrolled to future students in cinematographic form. Students will see our generals walking about and our men preparing for a concerted attack with all the vividness of an eye-witness. Along with the charges and more thrilling parts of the conflict will be shown

FUTURE OF MOTION PICTURES

the work of the Red Cross, bayonet drills, map-making, and general preparations behind the lines, with the history of a shell from the time the ore is taken from the ground until it is discharged into enemy territory.

Not only will motion pictures come to be a phase of increasing importance in the school, but also will they come to be more and more a matter of family entertainment and instruction. The manufacture of portable projection-machines will make motion pictures in the home a matter of common acceptance. The present public libraries will be augmented by film departments where films of an educational or patriotic nature can be obtained and taken home to be put on small projection-machines and exhibited to the family. At the expiration of a certain number of hours, or days, the films will be returned to the library, where they will be inspected and turned over to the next in line, much after the fashion of the withdrawal and the return of library books of the present day.

Not only will films of an educational or juvenile nature be thus exhibited in the home, but films far more intimate and personal will be in the possession of the average family. Films showing the baby in arms; the childhood and youth of members of the family, will be taken by a photographer coming to the home, and later these films will be put on the family projecting-machine and exhibited to properly appreciative audiences. The motion-picture projector standing in its mahogany case will replace the family photograph-album so dear to the hearts of another generation.

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Community instruction will be taken over by a specially organized branch of the United States government so that bodies of individuals of related interests will be instructed *en masse*. The latest and best methods of gardening will be shown free in village theaters, and automobile vans will travel agricultural districts fully equipped for setting up tents and showing farmers at their homes the best farming methods. Before the farmers are ready to plant corn they will be given film instruction in selection of seed and germination, with similar instruction in the planting of spring and fall wheat, with best methods of safeguarding against weevil and blight.

Not only will state and government films be used in mass instruction, but the different states will use them as a means of keeping agriculturists on the soil. These films will be prepared under state and governmental supervision and will be taken to the smallest and farthest outlying communities and shown to the people there free of charge. The films will not only be educational, but of story interest, so that tillers of the soil will not be flowing to the cities in such unceasing numbers to find something to relieve the monotony of their rounds.

Films will be given a direct and local interest impossible to even the best of dramatic subjects by rehearsing plays with the farmers themselves as actors. The men of the soil will be drilled, rehearsed, and a play put on with all the parts taken by local individuals. In crowd scenes hundreds of people will be shown, that the interest may be as

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wide as possible. The film will be developed at the state's expense and returned to the people free of charge, that they may have the pleasure of seeing themselves in film form. Thus motion pictures will be used in farming districts with the state's backing for both instruction and amusement.

At the writing of this volume motion pictures are twenty-four years old. From the first crude, groaning experiment performed in the Indiana jewelry-store motion pictures have risen from an unnamed novelty to the fifth industry of the world. They have accomplished as much in a quarter of a century as printing did in two hundred years and as much as drama has since the death of Shakespeare.

The possibilities of motion pictures are apparent to an observer of their trend and a prophet of their future by the fact that they combine the appeal of acting, reading, and painting, and when shown with music add to the faculties stimulated that which is reached through the ear. They are the universal art. They have outstripped the theater in importance and have surpassed painting and magazines, and now have left as a contestant of public attention only the daily newspaper. Soon they will outstrip it—and then continue to advance in importance and scope.

They will be a factor in the birth of a child, for by motion pictures the attending physician will be instructed for what is before him; by their means the mother will be taught hygiene and care of the child; by them the child himself will be instructed in school, drilled in military service, prepared for

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citizenship, instructed in his choice of a life's work whether for office or factory, helped in his illnesses, entertained and amused as he goes along life's way, and finally his obsequies will be recorded and shown to those interested by the same celluloid means.

THE END



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